28 PAGES OF RASPBERRY PI
» BigTrak upgrade » OS test & more

FREE DOWNLOADS
FOSS, code & tutorial files

www.linuxuser.co.uk

LinuxUser & Developer™

£750 OF PRIZES TO BE WON

BUILD A SUPER RASPBERRY PI

Qt

MODEL DATA WITH QT
Learn to use List Models

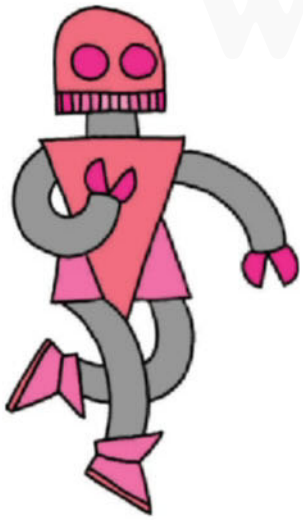
10 EXPERT TUTORIALS
• MRTG • OrangeHRM
• Jenkins • SonarQube

VIRTUAL BOXES WITH PUPPET & VAGRANT
Deploy, configure and manage multiple boxes

HUMMINGBOARD-I2EX
SolidRun's powerful new SBC tested

10 YEARS OF UBUNTU
Celebrating a decade of Ubuntu and revealing its future

ip IMAGINE PUBLISHING
DigitalEdition
GreatDigitalMags.com
ISSUE 145



code club

Can you volunteer for Code Club?

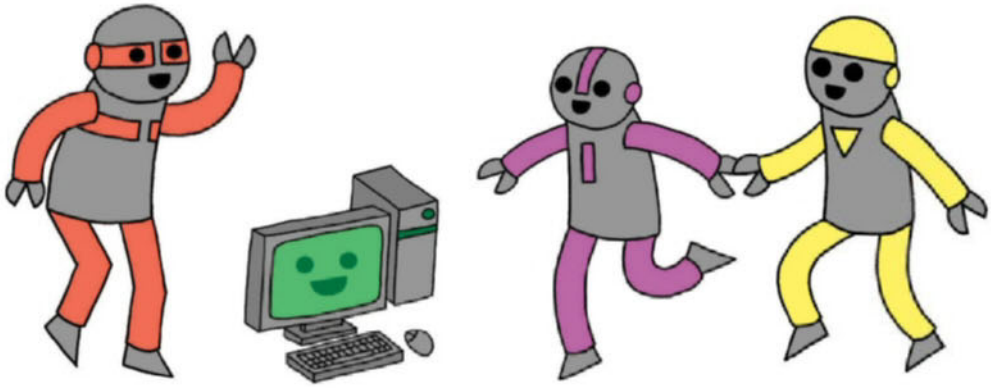
Code Club is a nationwide network of volunteer-led after school coding clubs for children aged 9-11.

We need people who know how to program computers to volunteer to run a club at their local primary school, library or community centre for an hour a week.

We create the projects for our volunteers to teach, the projects we make teach children how to program by showing them how to make computer games, animations and websites.

Get involved, let's teach the next generation to code!

Visit **www.codeclub.org.uk** to find out more



Welcome

to issue 145 of Linux User & Developer

Your team of Linux experts...

Rob Zwetsloot studied aerospace engineering, using Python to model complex simulations. Having set SuperPi (p.50) to work on the algorithm for perfect orange and aubergine cake, for Ubuntu's birthday (p.16), Rob brought LU&D servers to their knees. The cluster won't stop downloading recipes and refuses to power down.

Richard Smedley started using computers long before WYSIWYG and still maintains that the command line, and Emacs, is the most productive working environment. Richard continues his column on open source start-ups this month (p.13) and begins a two-part guide to deploying virtual boxes with Puppet and Vagrant (p.26).

Nitish Tiwari is a software developer by profession and an open source enthusiast by heart, and he helps firms set up and use open source software. This issue, Nitish shows us how to manage employees with OrangeHRM (p.34) and continuously analyse code by combining Jenkins and SonarQube (p.38).

Mihalis Tsoukalos is a UNIX system administrator with expertise in programming, databases and maths. He has been using Linux since 1993. Mihalis shows us how to use MRTG and SNMP to display the traffic load on a Cisco router, as well as how to configure Apache to view the output from your network (p.30).

Jon Masters is a Linux kernel hacker who has been working on Linux for some 18 years, since he first attended university at the age of 13. Jon lives in Cambridge, Massachusetts, and works for a large enterprise Linux vendor. You can find his brilliant Kernel Column on pages 14-15 this month.

Gareth Halfacree is our resident news reporter and brings us the latest developments from all over the open source world, starting on page 6. This issue, Gareth tests SolidRun's new computer-on-module plus carrier board design, the Hummingboard-i2eX (p.80).

This issue

- Beowulf cluster with Pi
- Modelling data using Qt
- Puppet + Vagrant virtual boxes
- £750 worth of prizes up for grabs

Welcome to the latest edition of Linux User & Developer, the UK and America's favourite Linux and open source magazine.

We've shown you how to power up your Raspberry Pi before, but this time we're taking a different tack. Rather than focus on modding, overclocking or otherwise souping-up your Pi, we're showing you how to connect together multiple Pis – as many as you can get your hands on – into a powerful Beowulf cluster capable of far more advanced calculations than a single Pi could ever hope to achieve. Turn to page 50 to get started.

And this month we send birthday wishes to Ubuntu, as the 14.10 release marks its tenth year in the world. Head to page 16 to find out where this game-changing distro came from, and where it's going next, as we get Canonical's inside story.

We also have two great Raspberry Pi competitions for you this month: you can win yourself a BitScope Micro oscilloscope or a brand new FUZE – we have five of these to give away! See page 10 to find out how to enter, and check out the tutorials we have on the FUZE (page 46) and the BitScope (page 64) if you want to learn more about them.

There are more fantastic tutorials lined-up for you too, covering Qt, Jenkins, Vagrant and more. Enjoy your issue.

Gavin Thomas, Deputy Editor

Get in touch with the team:

linuxuser@imagine-publishing.co.uk

Visit us online for more news, opinion, tutorials and reviews:

www.linuxuser.co.uk

LinuxUser & Developer

Contents

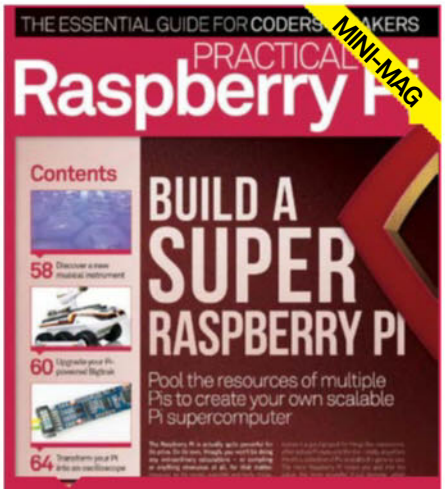
OpenSource

Features

Tutorials

FileSilo.co.uk

Reviews



Join us online for more Linux news, opinion and reviews www.**linuxuser**.co.uk

NEW: DEDICATED SERVER BUSINESS LINE

Trust is important when it comes to choosing the right server provider. With 13 years of server experience and 6,000 employees in 11 countries, 1&1 is one of the largest Internet service providers in the world and a company you can trust. Benefit from our expertise and the maximum security offered by our high-tech data centres.

NEW! **Dedicated Server Business Line X8i and X10i, built on Dell™ PowerEdge™ R630 hardware**

- Latest Intel® Xeon® processors E5-2600 V3 (up to 10 cores HT/2.3 GHz) and 128 GB DDR4 RAM
- Up to 6 TB HDD, Hardware RAID 6 and optional Intel® SSD hard drive
- 1 Gbit/s connection with unlimited traffic
- Maximum security due to redundant components
- Conveniently connect your server to your existing Dell™ infrastructure with Dell™ OpenManage™ Essential Tools

The complete 1&1 Server range: Great entry-level web servers from £19.99 per month, to high-end servers with the highest capabilities. Visit 1and1.co.uk

BUSINESS LINE by Dell™

From **£199.99** per month* excl. 20% VAT

1 TRIAL TRY FOR 30 DAYS

1 MONTH SHORT TERM CONTRACTS

1 CALL SPEAK TO AN EXPERT

0330 123 0274

1&1

1and1.co.uk

* 1&1 Dedicated Server X8i from £199.99/month with 24 month contract term. 1&1 Dedicated Server X10i from £249.99/month with 24 month contract term. 12 month and 1 month contract terms also available (prices vary). £99 setup fee applies for all contract terms. All prices exclude VAT. Visit www.1and1.co.uk for full offer details, terms and conditions. Dell, the Dell logo, the Dell badge and PowerEdge are trademarks of Dell Inc.

CANONICAL

Netflix service will finally get native Linux support

No more hacks required for browser-based playback

Subscription-based video streaming service Netflix has confirmed that it is working on bringing its browser-based playback system to Linux desktops, and is working with Canonical to introduce support into the Ubuntu Linux distribution.

Netflix is an incredibly popular service originally launched in the US offering films on DVD via post. This was soon overtaken by a video streaming service, which was launched in the UK in 2012 and that now boasts more than 50 million subscribers in 40 countries. These users pay a monthly fee for the opportunity to stream unlimited film and TV content in resolutions up to Ultra HD (4K).

Sadly for Linux users, the digital rights management (DRM) wrapper that protects the Netflix content has been unavailable on Linux, with the exception of support introduced into Google's Chrome OS in 2011 – until now. Netflix has confirmed that an update to the Network Security Services library enables the Google Chrome Stable browser to play Netflix content officially on Ubuntu Linux for the first time in the company's history.

Previously, Linux users with Netflix subscriptions have had to install beta packages and then modify their browser's User-Agent string to enable playback. Paul Adolph, an engineer at Netflix, was the first to suggest this would change: "Netflix will play with Chrome Stable in [Ubuntu] 14.02 [sic] if NSS version 3.16.2 or greater is installed," he explained in a post to the Ubuntu-Devel-Discuss mailing list.

Adolph went on to explain that if Canonical could roll out 3.16.12 or newer as standard to Ubuntu 14.04, as a replacement for the 3.15.x tree locked into the long-term support (LTS) released earlier this year, "Netflix would be able to make a change so users would no longer have to hack their User-Agent to play."

Canonical confirmed to the list that it would do precisely that, with engineer Marc Deslauriers stating that he was "planning on bumping NSS to 3.17 in the stable releases as a security update [anyway]." This has been carried out for Ubuntu 14.04 and 12.04 now, putting native Netflix support a mere apt-get update away for Canonical's many LTS users.

"I can make a case here to lift the User-Agent filtering which will make Netflix HTML5 play in Chrome turnkey with no hacks required," Adolph responded, referring to server-side filtering that enables playback only on a preset whitelist of User-Agent strings which does not yet include Chrome on Linux. At the time of writing, that change had yet to be made; users who want Netflix playback in Chrome on Ubuntu and who have received the updated NSS package are advised to modify their User-Agent string to match Chrome on Windows until the change is made.

Thus far, Netflix has not publicly reached out to any other Linux distributions to offer native playback support, nor indicated if it intends to formally support browsers other than Chrome on the platform.

Above Netflix has worked with Canonical to bring native playback to Ubuntu for the first time

Right Using the latest Google Chrome browser, native HTML5 playback is supported on Ubuntu

ARCHITECTURE

Red Hat pushes 64-bit ARMv8 support

Has eyes on the low-power data centre market

Red Hat has confirmed that it is heavily backing the 64-bit ARMv8 instruction set architecture (ISA) from Cambridge-based ARM, promising "a seamless experience" for its users across all supported ISAs.

Although delayed, the ARMv8 ISA is turning heads in the industry thanks to its high performance per watt characteristics. Although unable to offer the same raw peak performance as 64-bit x86 chips from AMD and Intel, ARMv8 processors draw considerably less power, enabling for higher density in the data centre – perfect, its proponents claim, for cloud computing tasks.

Red Hat has confirmed the launch of what it describes as the ARM Partner Early Access Programme to speed up the adoption of ARMv8, which is not compatible with x86 and AMD64 ISAs. "Within the 64-bit ARM ecosystem, Red Hat is focused on creating a singular operating platform that relies on common standards to foster the development of new applications," the company claimed in a launch statement. "The goal is to maintain expected enterprise-class attributes such as reliability, security, and performance for applications that are largely available today as open source projects."

Although Nvidia and Samsung have both backed away from plans to release server-centric ARMv8 processors, companies including AMD and AppliedMicro have products available in the market now.

Above Red Hat is forging ahead with support for ARM's latest 64-bit instruction set architecture

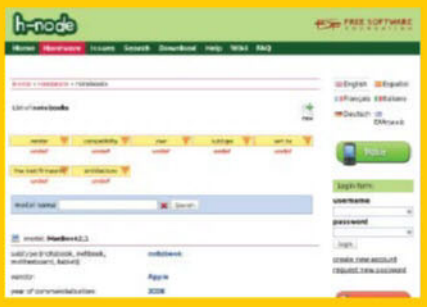
FREE SOFTWARE

FSF & Debian partner on free hardware database

The Free Software Foundation and the Debian Project have joined forces to expand and enhance h-node, a database of hardware that can be used under Linux without any proprietary software or firmware.

"By collaborating with h-node, Debian for the first time has the opportunity to join efforts with other free software communities on the assembly of a database of hardware that doesn't require anything outside the Debian main archive to work," explained Lucas Nussbaum, Debian Project leader of the move which will see the FSF providing infrastructure and support.

Previously, Debian users were not permitted to contribute to the database due to the presence of non-free repositories. The partnership will see h-node accepting contributions from Debian users providing they are using only the default free software repository for testing.



Above Debian users can report compatibility information to the h-node database

Linux calendar

19th - 21st November

CloudStack Collaboration Conference Europe

» Corinthia Hotel, Budapest
» Hungary
» events.linuxfoundation.org

Taking place alongside ApacheCon Europe, CCCEU concentrates on the OpenStack platform for the deployment and management of virtual machines as Infrastructure as a Service (IaaS).

17th - 21st November

ApacheCon Europe

» Corinthia Hotel, Budapest
» Hungary
» events.linuxfoundation.org

Designed for developers and users who want to address open source 'the Apache way', sponsors of ApacheCon Europe include Citrix, the Apache Software Foundation and WanDisco.

17th - 21st November

SUSECon2014

» Hyatt Regency Grand Cypress
» USA
» susecon.com

Designed for SUSE users and developers, confirmed speakers include SUSE president Nils Brauckmann and vice-president Michael Miller along with Forrester Research analyst James Staten.

3rd - 5th November

Code Mesh 2014

» ILEC Conference Centre, London
» UK
» codemesh.io

Starting with a day of tutorials before the two-day conference, Code Mesh offers a look at technology and programming languages off the beaten path including Datomic, Neo4j, F# and Haskell.

MOZILLA

Mozilla Labs shut down

"I don't believe Labs was effective," says Ian Bicking

Mozilla Labs, a think-tank and software development group in the Mozilla Corporation, has been closed down with many of its alumni shifting to the Mozilla Foundation instead.

Used for research and development, Mozilla Labs was home to everything from the JavaScript-powered PDF.js in-browser PDF viewer to the Tomahawk cross-platform media player. Some projects from the site, including the Open Badges Initiative and the aforementioned PDF.js, proved extremely successful; others less so.

This month, former Mozilla Labs staff member Ian Bicking posted to his blog confirming that the division had been formally closed, something that up to that point Mozilla had not announced itself.

"It's a little hard to tell – I guess we didn't actually shutter anything, and though it was announced internally it is entirely unclear externally," he explained. "But Mozilla Labs is definitely shut down. I understand the reason for closing Mozilla Labs. I don't believe Labs was effective [and] I was not effective in it," Bicking adds, before clarifying that Mozilla Research, which focused more on foundational web technologies than on software development like its sister group did, is still very much active.

Mozilla has since confirmed the quiet closure of the division, stating that it was officially closed down in February this year with no public notification. Mozilla's Andreas Gal told website **i-programmer.info** about the move: "We integrated Mozilla Labs staff more closely into product teams instead of maintaining Mozilla Labs as a separate team... This allows each team to better sponsor research and innovation for their products."

At the time of writing, Mozilla had yet to modify the Labs website (**https://mozillalabs.com/en-US**) to indicate its closed status.

Above Mozilla closed its Labs division in February, but that fact has only now become public knowledge

OPEN SOURCE

NHS adopts open platform database

Spine2 system goes live with Ubuntu core, replaces decade-old predecessor

The National Health Service (NHS) has sent its Spine2 patient record database and messaging system live, replacing its proprietary Oracle predecessor with a fully open-source software stack.

First announced in 2013, Spine2 uses a bevy of popular open-source packages to drive the giant database: Ubuntu with HA Proxy, nginx, Puppet, Mustache, Flask, Python, Redis, RabbitMQ and Tornado, along with Riak to ensure data persistence. The system scales across commodity servers using Intel Xeon processors in multiple data centres.

"We have harnessed the latest technology to rebuild the most important NHS electronic system, built over ten years ago and today relied upon by thousands of health staff and patients every single day," boasted Health and Social Care Information Centre (HSCIC) chief executive Andy Williams of the project. "Of equal importance is [that] we have ensured value for money: by bringing the system in-house, the day-to-day running costs are set to fall substantially.

"Rebuilding such a massive and integral system was a huge challenge, not least in ensuring more than 20,000 organisations and the many thousands of people who rely on the system were able to continue accessing the Spine during the transition with minimal disruption. I am delighted that the HSCIC, supported by the commitment of several other organisations, has achieved this."

The Spine2 project was supported by commercial partners BJSS and Basho, and represents one of the largest UK government deployments of an open software stack to date. Additional new functionality is planned for the system over the next year and this includes an information sharing application focused on child protection.

Above The Oracle-based NHS Spine system has been replaced with an in-house open software stack which is going to be managed in-house

EMBEDDED

Intel launches Edison

Dual-processor design aims for embedded market

Intel has formally launched its Edison embedded computing module, first unveiled at its developer conference earlier this year.

Unlike the original Edison design, the final retail model does away with the SD card layout in favour of a custom design no larger than a postage stamp. Despite its diminutive size, the module includes a 500MHz dual-core Atom processor and a 100MHz single-core Quark chip for use as a microcontroller. Also included is 1GB of RAM, along with 4GB of eMMC storage and both 802.11a/b/g/n and Bluetooth 4.0 radios.

The module comes with a Yocto Project build of Linux pre-installed and includes support for running Arduino code on the Quark, much like Intel's previous maker-themed development board the Galileo.

At the time of writing, Intel had yet to confirm UK pricing and availability with stock of the module selling out quickly in the US at a $49.95 retail price (around £31 excluding taxes).

Above The Intel Edison runs Yocto Linux and packs a dual-core Atom and single-core Quark

ORACLE

Larry Ellison steps down as Oracle CEO

Influence over the company unlikely to shift much due to new job titles

Larry Ellison has announced that he is to step down as chief executive officer of Oracle, the company he co-founded, after 37 years. Rather than leaving the company, however, he is to take on the dual role of chair and chief technology officer – leaving many to wonder if there will be any real diminishing of his influence.

Ellison is to be replaced by Mark Hurd and Safra Catz, who were the company's co-presidents before the announcemen and will be taking on the title of co-chief executives. "I'm going to continue doing what I've been doing over the last several years. [Hurd and Catz] are going to continue what they've been doing over the last several years," Ellison explained during a conference call announcing the move. "Mark and Safra have done a spectacular job and I think they deserve the recognition of their new titles." During the same call, Catz added that the move was largely ceremonial. "I want to make sure we are very, very clear. There will actually be no changes," she claimed during the call. "No changes whatsoever."

The executive reshuffle is not expected to have any effect on Oracle Linux, the company's own Red Hat Enterprise Linux-based distribution originally launched in 2006.

Competition

www.linuxuser.co.uk
For the latest news and views

Email us directly...
linuxuser@imagine-publishing.co.uk

Win £750+ worth of Pi prizes

WIN A FUZE

A modern-day mash-up of the Raspberry Pi and the classic BBC Micro, the FUZE is a programmable computer and electronics workstation designed to teach users how to program hardware and software. The Pi is housed just above the keyboard and there's space for breakout boards to be added to the FUZE IO board, which makes it easier to work with the Pi's GPIO ports. The FUZE comes with FUZE BASIC, Python and Scratch pre-installed, plus PDF project cards to get you started.

We're giving away five FUZEs – for a chance to win one you just have to send us your best FUZE BASIC project (details via the competition link below). To learn more about FUZE BASIC, head over to page 68.

» **1st Prize: FUZE T2-R (with robotic arm, worth £229.99)**
» **2nd Prize: FUZE T2-A (worth £179.99)**
» **Runners-up: x3 FUZE T2-C (worth £89.99)**

Closing date for entries **5 December 2014**

www.linuxuser.co.uk/news/win-a-fuze

Closing date for entries **21 November 2014**

WIN A BITSCOPE MICRO

The BitScope Micro is a pocket-sized oscilloscope that also functions as a waveform and clock generator, as well as a spectrum and logic analyser. It's an essential tool if you're serious about electronics, as you can use the BitScope to observe, measure and analyse signal voltages, and even capture both digital and analogue signals simultaneously. It's also user-programmable with C/C++, Python and Pascal for integration into any project, whether that's engineering, scientific research, education or simply some weekend hardware hacking. It also works in hot or wet field conditions, making it ideal for technical outdoor projects or even attaching to drones (it weighs in at just 12 grams).

Find out how to use the BitScope Micro with your Pi over on page 30, and enter the competition at the link below for a chance to win.

» **Prize: BitScope Micro BS05 (worth £88.60)**

www.linuxuser.co.uk/news/win-a-bitscope

TERMS & CONDITIONS

To submit your entries, go to the URLs supplied above and follow the instructions. The closing date for the BitScope competition is 21 November 2014, and the prize is a BitScope Micro BS05. The closing date for the FUZE competition is 5 December 2014, and the prizes are a FUZE T2-R for the first-place winner, a FUZE T2-A for the second-place winner, and a FUZE T2-C for each of the three runners-up. Please be aware that entries must be submitted via the above web addresses. Imagine Publishing has the right to substitute prizes for similar items of equal or higher value. Employees of Imagine Publishing (including freelancers), their relatives, or any agents are not eligible to enter. The editor's decision is final, and no correspondence will be entered into. Prizes cannot be exchanged for cash. Full terms and conditions are available upon request. From time to time, Imagine Publishing or its agents may send you related material or special offers.

24/7 UK expert support

UK data centre

Dedicated to my business

99.99% uptime guarantee

Allowing businesses to do what they do best

Give your business the edge with Fasthosts range of Professional Series Dedicated Servers.

With 99.99% uptime guaranteed, SSD technology for faster performance, substantial storage drives and with **FREE** set up, there's a server to suit all budgets and business needs.

- **Full remote KVM control**
- **Up to 128GB RAM**
- **Unlimited bandwidth**
- **NEW cPanel and WHM**

Dedicated Servers from:

FOR 12 MONTHS

£29.00

Per month ex VAT. Normal price £39.00 per month ex VAT
12 month minimum term contract. One-off setup fee £49.00 ex VAT

Call **0808 1686 777**
or visit **fasthosts.co.uk**

SERVERS · WEB HOSTING · DOMAIN NAMES · EXCHANGE EMAIL

fasthosts
Inspiring Better Business

THE FREE SOFTWARE COLUMN

A price to pay

For a successful open source company, the lack of process control is just a small price to pay in the grand scheme of things

Richard Hillesley writes about art, music, digital rights, Linux and free software for a variety of publications

Open source is everywhere, but the term is often applied loosely. Free and open source software is attractive to hardware and software companies because it seems to be the cheap and efficient option and gives access to communities of users and developers who bring cost reductions and opportunities for high quality input from a variety of sources. Corporate involvement in open source software development works for developers as it pays their wages and, if properly managed, allows them the freedom to work on the code. But open source's success is not without its drawbacks.

The definition of open source is continually being redrawn, sometimes meaning little more than 'parts of the code are visible to some interested parties'. Open core licensing, for example, was popular among some start-ups and smaller open source companies; this is where some part of the core code is released under an open source licence but key parts of the code retain a proprietary licence, meaning that the open source segment of the code is incomplete and often unworkable. Open core, or something similar, is still common among smaller software companies, although seldom advertised as such. It's often supplemented by dual licensing and copyright assignment regimes where the developers hand over the ownership of their code to a third party, usually the controlling company. The intention is often benign. The effects are less predictable.

Copyright assignment can be ethical and can unify a project under common ownership, or it can be misused to impose control and bypass the GPL, indemnify the code against patent infringement and then subvert the developers' intent in contributing to an open source project. Copyright assignment and dual licensing have been an effective means in the past for distributing free products like Qt and MySQL. But the more the definitions of free and open source software are loosened by such concepts, the less effective it will be in spreading its ideals and in recruiting the developers and the users who are the reason for its success. Companies are not always ethical; after all, their primary objective is to maximise the shareholders' investment return. Open source is only attractive if it extends profit opportunities. Companies collaborate when it pays, but are often ruthless and sometimes short-sighted when quantifying the returns from free software. But there are honourable exceptions to this role: Red Hat, for one, has tried to stay true to its principles. The company has been recognising that its success as an open source company lies in encouraging the developers' initiative and freedom.

Red Hat ensures separation between the developer process and the final product by taking snapshots of the community project, testing and redefining the snapshot for release as a commercial product, and then adding and feeding back refinements rather than exercising control over the developer process. Fedora is a 'state of the art' bleeding edge distribution and Red Hat makes substantial contributions to the kernel and other community driven projects. The company does not 'own' the code, but this does not impair its final product. Fostering the interests of a community may be counterintuitive to companies that grew up in an era when software development and production was predicated on a closed-source model with high internal development costs and fixed revenue streams. But loss of control of the process is part of the price to be paid for the much greater gains that come from being open source. From an understanding of both sides of this dilemma has come the advantage upon which Red Hat has built its commercial success. The problem for users and developers of free software is that, too often, this kind of dilemma translates into compromise. The GPL and the LGPL can be compromised by community agreements and copyright assignment clauses which pass ownership of the code to the holding company and also allow relicensing and consequent dereliction of the patent clause and the other protections of a copyleft license.

Free software and collaboration for mutual interest has pushed down development costs across the industry, a pattern that is repeating itself across several other industries. To this extent there has been an industry-wide acceptance of the inevitability of free and open source software. But if free and open source software is to remain free, compromise is not always desirable.

> "Companies collaborate when it pays but are often ruthless when quantifying the returns"

THE OPEN START-UPS COLUMN

Free or open?

Developers who depend on open source software want to give back to the community, so how do start-ups square this with commercial pressure?

Richard Smedley is a Unix and networking jack-of-all-trades, specialising in free and open source software

Right Moltin is an eCommerce platform providing an API for easily managing stores and shopping carts

Newspaper headlines occasionally remind us that 'UK business lags in open source adoption' but more pertinent to the UK free software community is the question: what are businesses contributing back? Start-up companies tread a fine line here between the open source culture that most coders now inhabit and the demands for protection of so-called Intellectual Property (read more at **www.gnu.org/philosophy/not-ipr.en.html**) from their backing investors.

Some companies release final products lacking certain features unless you purchase the non-open version. Another alternative is to release the tools and platforms that helped you build your project – such as Rails, which came from Basecamp. One good example here is Moltin, a Newcastle-upon-Tyne-based start-up on the Ignite100 start-up accelerator programme, which provides an API and SDK for building eCommerce sites and is aimed at removing the pain that developers experience using current solutions.

"We wanted to provide developers with a number of components allowing them to create simple stores while still providing the more complex aspects in our commercial service," Moltin cofounder Adam Sturrock told us. Coming from the frustrations of working with eCommerce software as a developer at a web agency with fellow founder Jamie Holroyd, this was software very much driven by the need to fill a void for users, but licensing decisions have been business-driven: "We spent a while thinking about what made sense for us to release as open source and what to keep internal, and [we] feel we struck a good balance in the end. Going forward we have a number of additional projects and tools that we would look to open source."

Moltin have released open source PHP and JavaScript SDKs that handle the authentication process, "[allowing] developers to start making API calls even faster," says Sturrock of some of their software made available on their Github page and at **packagist.org**.

This pattern of giving back to the developer community, but not having a total commitment to free software can be seen across the web developer community, and a casual trawl through Github shows huge numbers of Ruby and JS tools for developers, as well as PHP libraries. "Our administration dashboard is built using our PHP SDK, the Slim PHP framework and Twig template engine," says Sturrock. "We are aiming to open source this in the near future for developers and agencies to improve, white-label and adapt.

"We have also built a number of tools using our SDKs to help jump-start development further with AngularJS-powered stores and a PHP frontend framework similar to our admin dashboard." It does have some advantages of course: "We tend to get a wide range of contributions from our users, ranging from fixing typos to bug fixes and additions/enhancements. We also get a number of feature requests for each of our packages which we evaluate to see what makes sense for everyone using it, trying to avoid adding features that have a slim use case"

As we mentioned last month, without free and open source software so much of what start-ups do simply wouldn't be possible. "Our REST API uses OAuth 2.0 to authenticate requests," says Sturrock. "Our API backend is built using many open source projects. The backend is written in the PHP Laravel framework and our databases run PostgreSQL and Redis. This means our API is infrastructure agnostic and we can be hosted and run from anywhere including our local machines to multiserver setups."

Next month we look at where GNU/Linux and FOSS fits in with some of the better-known financially successful tech start-ups.

JON MASTERS

The kernel column

Jon Masters informs us of the kernel's role in the latest Shellshock security vulnerability, and summarises the work in the kernel community towards a final 3.17 release

Jon Masters is a Linux kernel hacker who has been working on Linux for some 19 years, since he first attended university at the age of 13. Jon lives in Cambridge, Massachusetts, and works for a large enterprise Linux vendor. He publishes a daily Linux kernel mailing list summary at **kernelpodcast.org**

Linux turned 23 years old a couple of months ago, just in time for the tail end of the 3.17 kernel development cycle. In fact, the 5th Release Candidate was almost released on Linux's birthday but Linus decided against that as he is "not an overly sentimental person, so screw that". Indeed, this has been a quieter cycle in some respects and Linus considered making RC6 the final Release Candidate. In the end he did make, "yes, another rc", (RC7) since "'convenience' [to his travel schedule] isn't really part of the release criteria". We will have a full summary of Linux 3.17 in the next issue.

Is the Linux kernel 'shellshocked'?

A recent security vulnerability in the Bash (Bourne Again SHell) has had everyone talking about being 'shellshocked'.

It's strange to think of Bash as front-page headlines, but such is the world in which we live. When it's not featured on the front-page of the *New York Times*, Bash is a humble (yet almost universal) shell, most often experienced as the familiar Linux or Mac OS X command-line interface spawned when running a terminal emulation program (by clicking on the Terminal application icon). But Bash is also quite often the shell behind /bin/sh (which is usually a symlink to the bash executable) and is thus available to remote users who request a webserver to run (for example) a CGI script.

The specific security vulnerability in Bash is pretty straightforward. A bug was inadvertently introduced into Bash (several decades ago) which causes it to miss parse function declarations that are passed into it via the process environment. Like any other application, running instances of Bash have a Unix process environment which can be viewed or modified using the "env" command. The environment is simply a linear memory array of an arbitrary size sitting within the process' overall address space. It is defined in the kernel within the "mm" struct that forms a part of every process (called a "task" when seen within the kernel), and is accessed by kernel code using a macro such as current->mm->env_start (which would return a pointer to the environment of the currently running program). The kernel is involved in setting up the environment originally as part of the binfmt_elf code that sets up Executable and Linking Format (ELF) executables, such as Bash.

The environment of a process (between env_start and env_end) is visible to userspace through a global variable (extern char **environ), and through the file /proc/self/environ, where "self" can be replaced with another process ID if you have suitable capabilities (eg root) to read the environment of another process. The "env" utility (part of the "coreutils" Linux package on most distributions) simply reads an array of strings from the global Unix environ variable and displays them. These strings have a declarative form, such as can be seen in "HOME=/home/jcm" and are known as "environment variables". Various tools, such as the Bash shell, will also read these entries on start up and set various internal state based upon these variables. Environment variables can include function declarations (such as "x=() { :;}", which defines a function named "x" that does nothing) and these can be exported to subsequent commands through use of the "export -f x" command. Normally, this command will only cause the environment to gain an "x=() { :;}" entry, but there are other ways to set the process environment besides using "export", such as using the "env" command directly. This leads us to the now famous vulnerability test code:

```
env x='() { :;}; echo vulnerable' bash -c :
```

The second Bash process is passed in a function named "x" but erroneously executes the "echo vulnerable" command tacked onto the end in the course of parsing the "x" function environment variable. In fact if you were to remove the "-c :" from the end of that line and allow the second shell to remain running, you would notice that the "env" command doesn't show anything untoward (because it doesn't correctly parse the content either). However, running "cat/proc/$$/environ" to display the environment as directly reported by the kernel will show the "echo vulnerable" addendum. Newer fixed versions of Bash improve parsing and also append new "BASH_FUNC_" prefixes to exported functions. But the kernel

continues to do its thing, having never been more than a spectator in the process of handing the environment from one task to another.

Ongoing Development

An interesting thread around the topic of non-blocking file reads spawned under the initial subject heading "read()/readv() only from page cache". The Linux page cache is an in-memory data structure containing data pages (fragments of disc files, also known as "inodes" in that context) representing those portions of files that have been previously read into memory and for which there is (at least temporarily) sufficient spare RAM to keep a cached copy on hand in case of imminent repeat access. The idea of reading file data only from the page cache is that file reads can often block for very long periods of time (milliseconds): more than enough time to ruin any kind of determinism in a low latency or real-time system. Typically, special purpose real-time systems take precautions around data storage for these reasons. But there are those who would like to use a general purpose file system and simply leverage the presence of the page cache, allowing for per request control over whether a read operation will block, should data not be previously cached therein.

New patches for POWER8 architecture support were posted, including a selection of the CPU type itself, as well as support for controlling attributes of the Transactional Memory hardware support when in use by a particular process undergoing debug through the ptrace API. Transactional Memory is a pretty nifty feature that several architectures are growing support for (recent x86 chips ship with this feature built in). It allows a sequence of memory operations to be treated as a unit that will either be completed entirely (and atomically) or not take place at all. It's typically used to implement various high performance critical sections in place of conventional locking (hence Intel use the term Transactional Synchronization Extensions or 'TSX' in their implementation), and are usually achieved by restricting the size of an overall transaction to a multiple of the L1 cache line width and using cache organisational tricks.

Community-run Linux Plumbers Conference is seeking organisers for its 2015 event. The LPC is contemporaneously co-located with Linux Foundation events such as LinuxCon, and under the overall technical direction of the Linux Foundation Technical Advisory Board (TAB). The new TAB was announced this month following fresh elections held at this year's LinuxCon in Chicago (full disclosure: this author was nominated to stand in absentia) and it is seeking assistance in organising the event, to be held in Seattle. The new TAB sees the departure of several long-term members and the addition of a few fresh faces including the new chair, Grant Likely. It's particularly gratifying to see that the ten-person TAB now has two female members (with the addition of Kristen Accardi, joining Sarah Sharp). This is of course far from enough, but it is at least a welcome trend in a positive direction.

Finally this month, a patch was recently posted that enables support for the upcoming GCC 5. For those who find the notion of experimenting with new and novel compilers interesting, this is definitely something to take a look at.

"A bug was inadvertently introduced into Bash several decades ago"

10 Years of Ubuntu

10 Years of Ubuntu

Celebrate the distro's birthday with a look back at its history

FEATURE

We celebrate a decade of the distro by looking back at Ubuntu with its movers and shakers

Ten years ago this month, a seemingly unassuming distro nicknamed Warty Warthog emerged in the Linux landscape and set in motion a cultural landslide that would see Linux rise from the shadows of the archetypal operating systems and become, in 2014, a household name. Since October 2004, Warty Warthog has evolved through numerous forms into Utopic Unicorn, the latest version of Ubuntu.

A catalyst for change, Ubuntu has achieved a great deal in its first fabulous decade. It pioneered the idea of a Linux operating system that just worked straight out of the box, without the need to manually troubleshoot and configure your hardware. It popularised the graphical interface that we use for most of our distro installations today, making them more accessible and easier to use, as well as the long-term support releases that many of us rely on for our main computers. It sharply divided opinion by having an opinion on the future of desktop and mobile operating systems, predicting convergence and boldly taking a hand in preparing the way.

Two forces are driving Ubuntu forward that, together, have found a degree of success in getting Linux into the public eye that very few other distributions have achieved: Canonical's leadership and the Ubuntu community.

The relationship between the two is an exemplary model of how open source companies can collaborate with their end-users in order to reliably deliver exactly what they want. Ubuntu contributors knows that they are heard by the Canonical team leaders, and the development process is incredibly democratic while still being rigid enough to adhere to Ubuntu's strict release schedule and LTS commitments. It's a delicate balance and Canonical struck it cleanly, producing quality Linux distros twice a year.

Today we look back at ten years of Ubuntu and celebrate the achievements of the developers and contributors who made it real for us – and look to the future, to see where we're going.

Jane Silber
Chief executive officer

Jane joined Canonical before the original Ubuntu release as the chief operating officer. She's worked on many Canonical projects and has a C and C++ programming background.

Martin Pitt
Software engineer

Martin was a prolific Linux developer for seven years before becoming joining the first Ubuntu developers. He now works in the plumbing layer, but used to do more for the distro.

Alan Pope
Applications project manager

A veteran of the Linux community, Alan was once a tech support volunteer on Launchpad. Now he coordinates with the community in making core apps for Ubuntu phones.

Richard Collins
Mobile product manager

Richard heads up the mobile side of Ubuntu. Before coming to Canonical he already had a mobile background from working at the Symbian foundation for many years.

Ubuntu the first

Warty Warthog was released on 20 October 2004 to a much different Linux world than today

There wasn't much branding on the original Ubuntu desktops. You can see here that it uses GNOME 2 as its preferred desktop environment

The original Ubuntu comes with a selection of default apps that look like a slice of open source history. GIMP is just one example

Ubuntu was one of the first distros to automount flash drives but you could still do it the – now literally – old-fashioned way

Like today, Warty Warthog shipped with Mozilla Firefox, although it was in one of the earliest forms of the browser

It's February 2004 and it's a very different world from what we know today. Windows XP is the latest desktop from Microsoft. Apple hardware is still running on PowerPC. BlackBerrys and PDAs dominate the smartphone market and x64 chips are just about making their way to market. Linux is barely in the zeitgeist outside of developer circles, but this is soon about to change.

"I was one of the first people Mark Shuttleworth called back then," said Martin Pitt, software engineer, who was there at the start of what would be a major revolution for the Linux desktop. "He sent me an email explaining his idea about doing a Debian-based Linux project with a regular release cycle that was also user-friendly."

This was the beginning of the development of Ubuntu 4.10, code-named Warty Warthog, and of Canonical itself. At the time, Linux desktops were very different. There were no graphical installers, there was no proliferation of user-friendly distros and very little push for 'normal' people to start using Linux.

"Canonical and Ubuntu officially started in April of 2004," elaborates Jane Silber, Canonical CEO. "[Mark] pulled a group of about ten people together with this vision of creating Ubuntu... I met him a couple months later in July and just immediately believed in the vision of Ubuntu and Canonical."

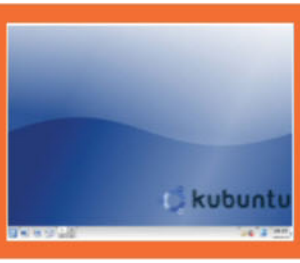
Jane later joined as the COO of the company and, after several months of development, the very first Ubuntu was released on 20 October 2004. The release was a bit slow catching on though, explains Martin:

Ubuntu timeline

20 October 2004

In the beginning...

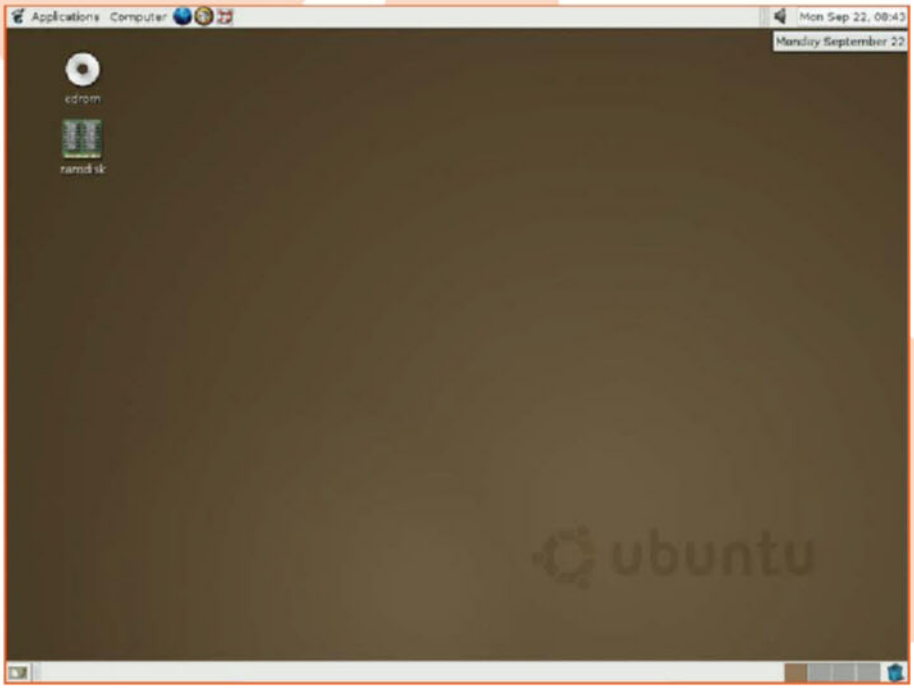
Ubuntu 4.10 Warty Warthog is released. Based on Debian testing and using the GNOME desktop environment, it was a solid first release. It wasn't an overnight sensation but it found a core group of loyal users.



18 April 2005

The first spin

Kubuntu was the first alternate flavour of Ubuntu, releasing shortly after Ubuntu came out and offering the KDE desktop environment as opposed to Ubuntu's default GNOME.



Left The basic GNOME desktop from the time. The live disc and install disc were once two separate images

The Linux landscape

Alan gave us an apt description of how Linux was in 2004

"At the time I had a Phillips webcam; on both Red Hat and Debian there was some trouble with it and I used to have to keep recompiling my kernel. That seemed like the thing that people did in those days. Something doesn't work, so you then get the kernel source and you run these obscure commands that may or may not work and may take a long time; eventually you get kernels that may or may not work. It may not even boot and, if it does boot, well maybe your webcam works, maybe it doesn't. I installed Ubuntu and my webcam just worked out of the box. I didn't have to do anything and I thought this [has] got to be the way forward."

"Development up until the first beta had been somewhat secret"

"To be honest it was still pretty much by developers for developers, so the immediate coverage was quite low. I prodded some famous German computer news magazines and [at] first they said, 'Yeah it's just another distro – why should we report about this?'"

Development up until the first beta had been somewhat secret and while the first release may have 'only' scored a few thousand users, its name started to grow throughout the Linux and open source community.

"I was in my local Linux User group in Hampshire and one of my friends knew that I was quite into Debian," Alan Pope, applications project manager, recalls. "He mentioned this thing, this new thing that was being developed by some crazy South African. I'd never heard of it as I wasn't on any Debian mailing list and I wasn't really involved with the Debian community or anything. But it looked quite nice and I installed it. That was late 2004 and that's pretty much it – I've used it solidly ever since."

While a small release at the time, 4.10's legacy is massive. It was relatively easy to install, had a desktop from the start that was preconfigured and would automatically mount flash storage. These elements have since been expanded upon greatly.

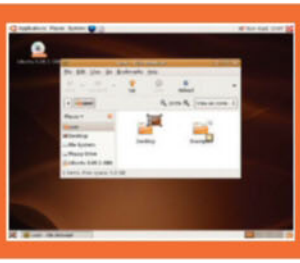
The developers were proud of their work and it wasn't long before 5.04 was in development. The next two years were very important for Ubuntu and would establish it as a household name among users and developers alike.

Above The original splash with the original logo, Ubuntu's preferences for orange has not changed much over the years

8 July 2005

Ubuntu Foundation

Created by founder Mark Shuttleworth, the Ubuntu Foundation is a trust fund to ensure the future of the distro. It's currently dormant but Canonical plan to treat it as an emergency fund if necessary.



1 June 2006

First LTS released

The original Long Term Support release of Ubuntu was delayed a few months from its intended April release date, but when it did come out it signalled a turning point in Ubuntu's popularity.

The early years

The meteoric rise of Ubuntu in the late Noughties caused a small revolution in the Linux desktop space

During the next couple of years a few things began to happen. Kubuntu 5.04 was released during the next cycle and is still being released today as one of the major Ubuntu spins. More features were being added by the release and, slowly but surely, Ubuntu was gaining popularity.

"It's a bit hard to say as it's always been an exponential growth," Martin tells us when we ask him which release really gave Ubuntu a foothold in the desktop Linux market. "But if I have to pick one it would be our first LTS, 6.06 Dapper Drake. That was explicitly announced for Long Term Support and we'd made particular efforts in stabilising it. It was also the first version with a graphical installer and thus made it a lot easier to do."

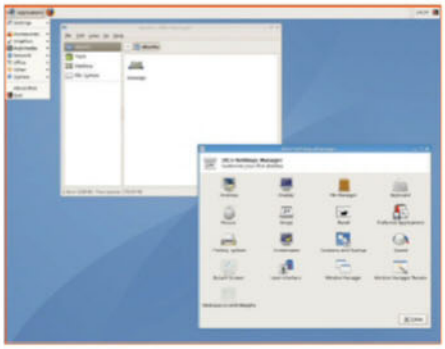
Above The first version of Unity was quite different to how it looks today

Version 6.06 is so far the only Ubuntu to be released outside of the months of April and October, gaining the .06 suffix after it was released on 1 June after a delay of almost two months. Support lasted for three years on desktop and five years on server, a practice that has since been stopped on LTS releases with both desktop and server versions now getting five years of support.

With the popularity came a fledgling community of users and developers. Alan has been part of this community from the start, answering people's problems on Launchpad during the free time he had with his jobs, and describes to us the evolution of the community.

"Back at the beginning, the active contributors were people who were bootstrapping things like getting IRC channels and mailing lists set up. This was all done by people with specific expertise, such as people who sat on IRC all day creating the Ubuntu IRC channels. You had people who were familiar with Mailman and they were setting up mailing lists, and people who knew about forum software would set up a forum. In the early days it was somewhat unstructured – but that was great, because we needed all of those things and it was very much a self-motivating, self-driving thing.

> "Once we got over that bump of creating the initial infrastructure, more people were able to contribute"



Above Xubuntu started to appear as one of the early lightweight spins in 2006

Someone decided 'we should have a forum' and they created one, and it became insanely popular, so once we got over that bump of creating this initial infrastructure and bits and pieces to get the project started, more people were able to contribute. It was then that contributions from the community started to take the more typical approach of doing translations, bug reporting, triage, submitting patches and producing documentation. That's the bread and butter contributions people do."

The community has continued to grow and has now become a very important part of Canonical, as Jane told us:

"The open source community and nature of Ubuntu, and cooperation between community and company, was one of the things I thought was just really unique and interesting about Canonical. I continue to think that's one of the places we've done really special work and continue to lead the field."

Ubuntu timeline

13 May 2009

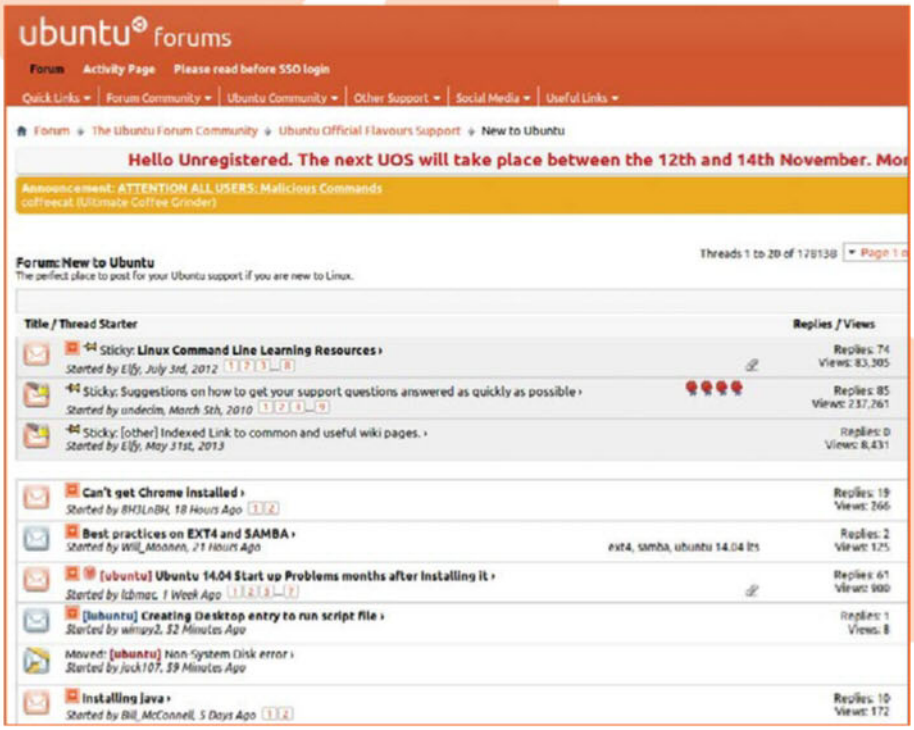
Ubuntu One launched

The cloud storage service was one of the first of its kind, originally named as it gave you access to 1GB of storage and was free for all Ubuntu users. It soon found its way into the desktop as an integrated service.

1 March 2010

Change of leadership

Mark Shuttleworth stepped down as CEO of Canonical so he could get closer to the development team at Canonical. Taking his place was Jane Silber, then the COO and still currently the CEO of Canonical.



Above The active community on the Ubuntu forums has been around for a long time

Since then, the community has worked on a number of Ubuntu projects. They've created manuals in PDF forms, translated them into different languages and started a better support site, which they named AskUbuntu (**http://askubuntu.com**).

Over the next couple of years, the community continued to grow and Ubuntu established itself as possibly one of these biggest Linux distros around, and certainly the most popular distro on desktop. In 2010, the grand vision of a unified desktop began with the release of Unity.

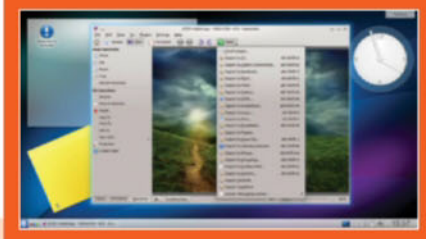
"I first saw something that looked very much like it at one of the Ubuntu Developer Summits when the design team were going over what the new shell might look like." Alan recalls. "I started using it fairly early on. It was a rocky road for about a year, year and a half. I like it, I enjoy using it."

But not everyone in the community agreed with Alan. "There were some very vocal people who decided this was not for them, they didn't like it and that's fine." Alan continued.

"I think in some ways that it has been blown out of proportion slightly and what a lot of people don't recognise is that Ubuntu ships by default on a lot of hardware around the world and Unity is the default desktop. I have no way of knowing if those people immediately go home and remove it and put KDE or Xfce on, and – to be frank – I don't really care."

Indeed, as Alan pointed out to us, there are a whole host of different desktops available in Ubuntu, in both the repositories and in the various alternate spins. Unity is at the heart of Ubuntu's design philosophy as it goes forward, though, moving towards a more unified future across all devices.

Ubuntu in all flavours



Kubuntu

The first major Ubuntu spin was Kubuntu, with the big difference being the inclusion of the KDE desktop. It was originally funded by Canonical but these days it's sponsored by a third party associated with the development of KDE. The beautiful desktop is quite different to Unity.

Lubuntu

The lighter version of Ubuntu using the LXDE desktop to maximise the amount of resources Ubuntu can use. This is useful for older or less powerful computers and can easily be scaled up to more powerful machines if you prefer the simple interface and want to get the most of your CPU.

Edubuntu

An educational spin on Ubuntu that supports the LTSP thin client so students can run the exact same distro at the same time. It's designed to be easily usable by teachers who want to create a computer lab or online classroom. It uses Unity and a variety of useful open source software.

10 October 2010

First taste of Unity

Unity was released with the netbook version of Ubuntu 10.10, giving users their first look at Canonical's new desktop environment. This was also the last release of the netbook version before it merged into the main distro.

28 April 2011

Unity for all

11.04 was the big release for Canonical as it began the company's vision of a unified desktop under the Unity environment. Based upon the then-new GNOME 3, 11.04 was in some way a GNOME shell alternative.

Now and into the future

How the future and the face of Ubuntu is being shaped right now by Unity and mobile

Right now, Ubuntu's focus is split between the desktop and the upcoming Ubuntu phones. Richard Collins, Ubuntu mobile product manager, has been working on the touch OS since he joined Canonical three years ago:

"The idea always came up about what would be the impetus, how would it work, etcetera. It really came from Ubuntu for Android and when we used that product to talk to many mobile manufacturers and mobile operators. The relationships were there and it was a reasonably rational development to start thinking about how Ubuntu as a code base would effectively be unique, in the sense that it could truly operate as a single code base across different form factors.

"It's where the industry was going anyway because you have touch-based laptops and big screens, so the evolution had already started to take place – it just required a strategic push to say 'Right, we're going to be doing the phone as a fully-fledged serious commercial product.'"

Not forgetting the community, Canonical got them very involved in development early on.

"One of the things we wanted to do was get the community involved with the phone, so it wasn't just us producing the phone and putting it out there. We wanted to get people involved. So we started this core apps project, and core apps are the typical applications you need on a phone like a clock or calendar. Then we've got some slightly more esoteric things that you might think are a bit out of place on a phone, like a terminal and a file manager. We have a weather app and a few others as well. All of those apps are developed by people in the community.

Left The latest version of Ubuntu carries on the legacy of Warty Warthog ten years on

Ubuntu timeline

2 January 2013

Ubuntu Touch

At a 2013 press unveiling, Mark Shuttleworth revealed the new Ubuntu mobile OS. The Unity interface had been scaled down to work on touchscreens and showed signs of the unified environment originally promised.

17 April 2014

The current LTS

14.04 is Canonical's most recent Long Term Support version of Ubuntu with five years of support, which appeals to enterprise for both desktops and server. It's a very stable release, focusing on bug fixing and not new features.

Above The apps are largely built by the community in conjunction with a proper design team

> "I think we've been able to strike a balance between the company and incorporating community input"

"These core apps specifically are done in collaboration with the Canonical design team, so the design team say 'this is what we think a clock app should look like' and they provide that design to us.

"We [looked] for people in the community who [wanted] to contribute an app to Ubuntu and sure enough we found a bunch of people who were willing to do so, and they created some of the apps that are going to ship on the many, many phones released over the course of the next year or so. That, for me, is brilliant. They'll be able to go to the store and buy a phone and their own code is running on that phone."

"It's been massive," Richard confirms the community's involvement. "The community is embracing everything that we [have done] and announced so fantastically well. A set of applications that are preinstalled on the phone have come from the community and there are hundreds more [that] people can download from the application store."

Richard also told us of some unspecified future announcements regarding the phone and an established roadmap for its development. What seems clear, though, is that the present and future of Canonical and Ubuntu owes a lot to the active community members who helped it grow. Jane reflected on this when we asked her about working with an open source company:

"I think we've been able to strike a balance between the company and incorporating the community input, work and enthusiasm quite well. It's not always a smooth road – [there are] rocky bits as there are in any relationship or any company. I think it's one of the most interesting bits about Ubuntu as a distro we continue even as we move into the phone and tablet world, and cloud on the server side. I think we continue to maintain a level of transparency and participation that's unique."

Above Ubuntu Touch's development is tied to Ubuntu for Android, the project for creating a dockable Ubuntu-running phone

A message from Jane Silber

"I personally, and we at Canonical, would like to thank your readers and people in the Ubuntu community who've participated, worked and celebrated with us over the last ten years. Clearly we wouldn't be here without their contributions, and I know part of your audience [are] developers. Devs in particular continue to be a very important audience for us. We hope we continue to bring them the best development platforms and development tools from Ubuntu itself; from Juju to the ability to spin up Ubuntu images easily in the cloud, we value that developer audience and hope we can give them the best tools possible for the next ten years as well."

3 July 2014

Goodbye Ubuntu One

After five years Ubuntu One is finally shut down. Due to the changing state of computing, Canonical felt it was no longer an effective service for their needs. Partnerships are the way forward for these kinds of applications.

23 October 2014

Ubuntu is 10

Coming out exactly ten years and three days after the original Ubuntu, 14.10 will continue the Warty Warthog's legacy of an easy-to-use Linux distribution, albeit now with a more unique flair thanks to Unity.

LinuxUser & Developer

SUBSCRIPTION VOUCHER

☑ YES I would like to subscribe to Linux User & Developer

YOUR DETAILS

Title_____First name_____

Surname_____

Address_____

_____

_____

Postcode_____Country_____

Telephone number_____

Mobile number_____

Email address_____

Please complete your email address to receive news and special offers from us

DIRECT DEBIT PAYMENT

☐ **UK Direct Debit Payment**

I will pay only £18 for 6 issues (saving 50%*)

Instruction to your Bank or Building Society to pay by Direct Debit

DIRECT Debit

Please fill in the form and send it to: Linux User and Developer Subscriptions Dept, 800 Guillat Avenue, Kent Science Park, Sittingbourne ME9 8GU

Name and full postal address of your Bank or Building Society

To: The Manager — Bank/Building Society

Address

Postcode

Name(s) of account holder(s)

Branch sort code

Bank/Building Society account number

Originator's Identification Number: 5 0 1 8 8 4

Reference Number

Instructions to your Bank or Building Society
Please pay Imagine Publishing Limited Direct Debits from the account detailed in this instruction subject to the safeguards assured by the Direct Debit guarantee. I understand that this instruction may remain with Imagine Publishing Limited and, if so, details will be passed on electronically to my Bank/Building Society

Signature(s)

Date

Banks and Building Societies may not accept Direct Debit instructions for some types of account — A6 instruction form

PAYMENT DETAILS

YOUR EXCLUSIVE READER PRICE, ONE YEAR (13 ISSUES)

☐ **UK: £62.40 (Save 20%)** ☐ **Europe: £70.00**

☐ **World: £80.00**

Cheque

☐ **I enclose a cheque for £**_____

(made payable to Imagine Publishing Ltd)

Credit/Debit Card

☐ Visa ☐ MasterCard ☐ Amex ☐ Maestro

Card number

_____ Expiry date _____

Issue number ☐☐ (if Maestro)

Signed

Date _____

Code: PAL143Q

Please tick if you do not wish to receive any promotional material from Imagine Publishing Ltd by post ☐ by telephone ☐ via email ☐

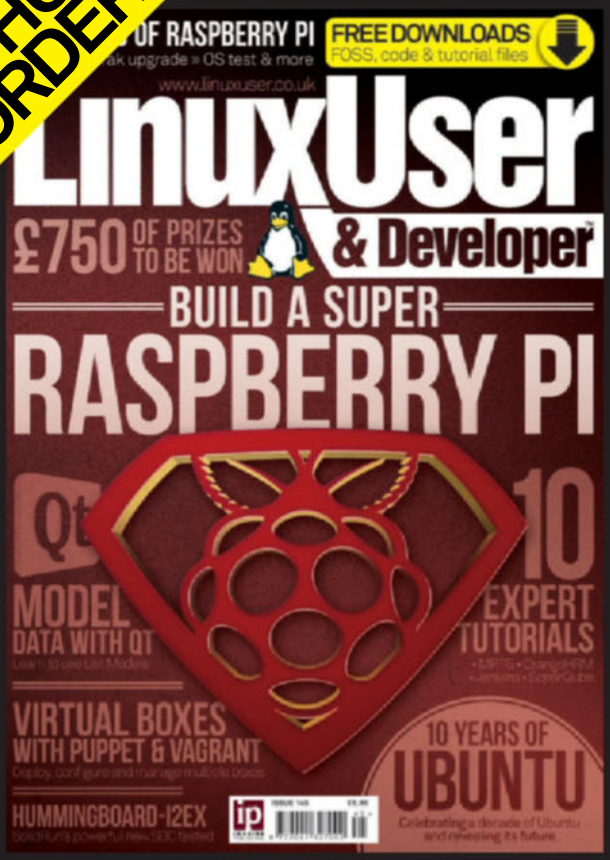
Please tick if you do not wish to receive any promotional material from other companies by post ☐ by telephone ☐ Please tick if you DO wish to receive such information via email ☐

Return this order form to:

Linux User & Developer Subscriptions Department, 800 Guillat Avenue, Kent Science Park, Sittingbourne, ME9 8GU or email it to lud@servicehelpline.co.uk

You will be able to view your subscription details online at www.imaginesubs.co.uk

HURRY ORDER NOW



FANTASTIC SUBSCRIBER OFFER

Subscribe today and save 50%

- Pay only £3 for every future issue – a 50%* saving on the store price
- Free UK delivery to your door
- Never miss an issue
- Money-back guarantee

*Terms & conditions: Pricing will revert to our standard offer of £25.15 every 6 issues on the third payment made. Subscribers can cancel this subscription at any time. New subscriptions will start from the next available issue. Offer code PAL143Q must be quoted to receive this special subscription price. Details of the direct debit guarantee are available on request. Offer expires 31st January 2015. Imagine Publishing reserves the right to limit this type of offer to one per household.

SUBSCRIBE TODAY & SAVE 50%*

Readers in the US see page 85 for exclusive offer

THREE EASY WAYS TO SUBSCRIBE

1. Online

www.imaginesubs.co.uk/lud

And enter PAL143Q

2. Telephone

0844 249 0282

And quote PAL143Q

3. Post or email

Please complete and post the form to

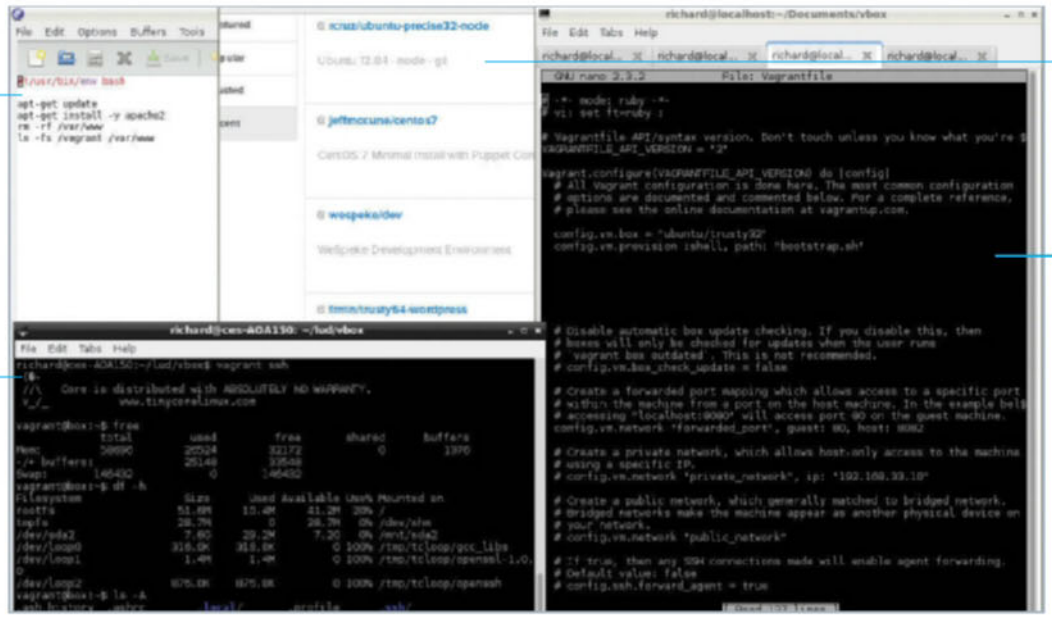
Linux User & Developer
Subscriptions Department
800 Guillat Avenue
Kent Science Park
Sittingbourne
ME9 8GU

Or alternatively, you can scan and email the form to

lud@servicehelpline.co.uk

Vagrant makes it easy to provision boxes with any development and deployment setup you need

Hundreds of base images are ready-made and additional software is ready-configured too



You will be in a working virtual box from scratch after just three vagrant commands (init, up and ssh)

Share your Vagrantfile and all your coworkers will have the same development environment on all platforms

Configure virtual boxes with Puppet and Vagrant – part 1

Make it simpler to develop all kinds of server apps and manage the deployment of new servers by using virtual machines

Advisor

Richard Smedley
A Unix jack-of-all-trades, Richard doesn't spend enough time in any language to get truly proficient, but always has a shell open so learnt scripting by osmosis

Resources

Ruby ruby-lang.org
Virtual Box virtualbox.org
Vagrant vagrantup.com/downloads

It may not ever be 'The Year of the Linux Desktop', but free and open source dominates the boxes where web apps live, so how do we develop for them across a heterogeneous environment? Vagrant holds together VirtualBox or any other virtualisation software – it works with Amazon EC2 and VMware, and can work with containers like Docker and OpenVZ. It can also work with various config tools to make an easy-to-manage, portable development environment.

Its greatest advantage is eliminating nearly all of the differences between development and deployment environments, drastically reducing unnecessary errors. As your needs grow more complex, Vagrant's close integration with config tools like Puppet will lift the admin burden from your shoulders.

Share the single config file (Vagrantfile) with your team, with or without Puppet invocation, and everyone will have the same environment on any platform.

Those who are hooked on Puppet, perhaps because of the tutorial we ran last year, will need no excuse to throw its configuration management powers at any appropriate problems. We hope we can convince the rest of you that it's worth learning in conjunction with Vagrant, but this month we'll get you going with Vagrant alone. First, let's make sure we're speaking the same language by updating your Ruby installation.

Puppet and Vagrant – part 1

Configure and deploy virtual boxes with Puppet and Vagrant

TUTORIAL

01 Ruby

While Perl and Python are the scripting languages that Linux distros and packages have traditionally depended upon, Ruby is the first choice for much of the DevOps and modern Web dev environment, and it's Ruby you'll need for Puppet and Vagrant.

```
ruby -v
```

... will tell you what, if any, version of Ruby you have. You'll need at least 2.0 for these tutorials.

There are options like rbenv to maintain multiple versions of Ruby easily on your PC.

02 VirtualBox

If the problem with versions is that you're maintaining a piece of software needing an older version of Ruby, then provisioning a virtual machine to run both that environment and your app is a great reason for following the tutorial.

Now, while you've got the package manager open, install VirtualBox too.

Your distro may have split out several separate packages, like the GUI interface virtualbox-qt. Make sure you get the package with the kernel modules virtualbox-dkms and the headers or source for the kernel you're running, as well as VirtualBox itself.

03 Get the latest

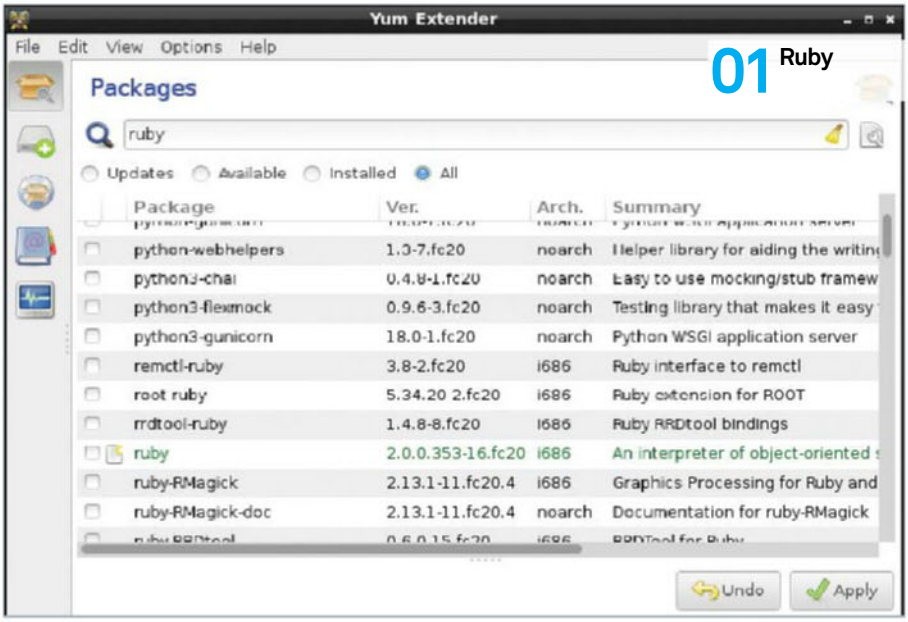
Now for Vagrant we go straight to **www.vagrantup.com/downloads** – RPMs and Debs are available in 32- and 64-bit flavours, and your browser will probably prompt you to open your package manager when you download.

There's no need to call your package manager – install manually using, for example:

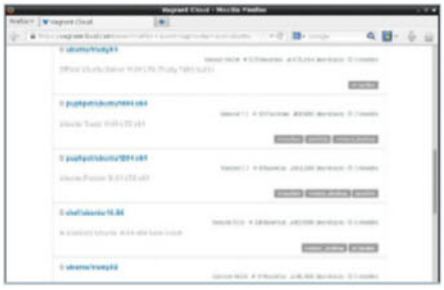
```
dpkg -i vagrant_1.6.5_i686.deb
```

... for the 32-bit package on Ubuntu or other Debian-based distros.

For other distros, download from GitHub and install with Rake, as outlined in the README on Vagrant creator Mitchell Hashimoto's GitHub page: **https://github.com/mitchellh.**



“Search VagrantCloud for lists of what you need in a setup”



04 Cloud-sourced

You'll need an OS image, and there are plenty available both at **www.vagrantcloud.com** and **www.vagrantbox.es**. You can search VagrantCloud for specific comma-separated lists of what you need in a setup such as jenkins,centos; wordpress,ubuntu; or rails,debian.

You'll find everything from minimal distros like Tiny Core (good for a quick download to test things out) to specialist, ready-rolled systems like data-science-toolbox/dst. For now, we'll stick to a basic setup of Ubuntu 14.04 – it's available from VirtualCloud in both 32- and 64-bit flavours.

05 Up and away!

Setting up a VirtualBox image from Vagrant is a simple matter of:

```
vagrant init ubuntu/trusty64
vagrant up
```

... which should download the Ubuntu 14.04 64-bit image from VagrantCloud and start it running. By default, the image should be kept in ~/VirtualBox VMs/ for subsequent use, but you can alter this in VirtualBox's preferences.

On most recent distros, everything should be hunky dory. But errors are not unknown, so we'll take a quick look at the most common problems.

06 Oops!

Problems? It's easy to miss the correct kernel headers during install. Check /proc /version (or run uname -a) to be sure which kernel you're running. Error messages from...

```
VBoxManage --version
```

... may help. On one Debian box, we had to rebuild virtualbox-dkms. For a Fedora test machine, we had to install the kmod-VirtualBox package for our kernel version, then run:

```
sudo systemctl restart systemd-modules-load.service
```

... which fixed the problem. You may find that a restart of your machine might be necessary for fixing problems.

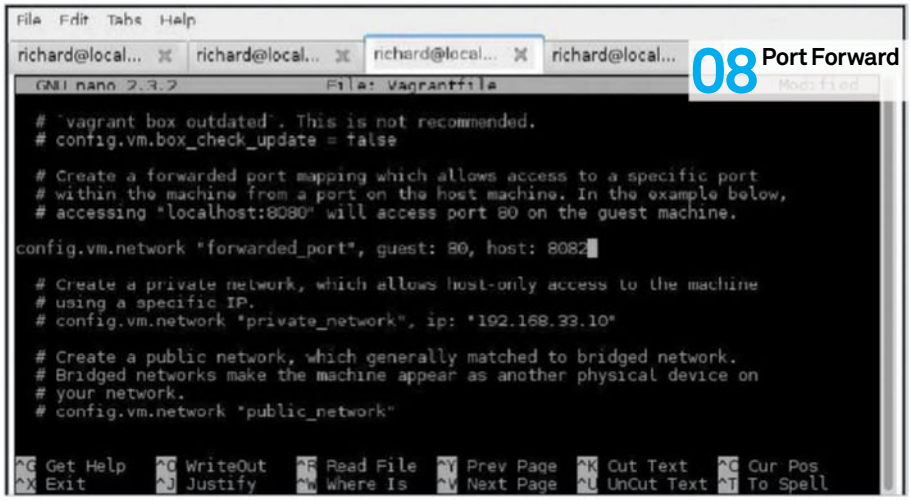
07 Vagrantfile

When you run vagrant init, you are told:

```
A `Vagrantfile` has been placed in this directory. You are now ready to `vagrant up` your first virtual environment! Please read the comments in the Vagrantfile as well as documentation on `vagrantup.com` for more information on using Vagrant.
```

Vagrantfile is where all of the configuration happens. Initially, everything is commented out save the config.vm.box value of ubuntu/trusty32 or whatever you set at vagrant init.

You can run vagrant init without a value and download the box you want later with the box add command. For example:



08 Port Forward

> **The base image remains unaltered when it is used, so can be shared among several projects**

```
vagrant box add outnorth/debian-7.4RubyRailsDev
```

... then add it to the config.vm.box directive in Vagrantfile. Note that the base image downloaded remains unaltered when it is used, so can be shared among several projects – each one will have its own Vagrantfile in the local directory in which vagrant init was run.

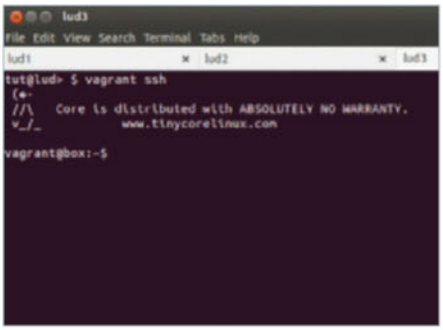
Whichever box you're running, setting up networking will be a necessity – you don't really want a website that can only be accessed from a local machine!

08 Port forward

In Vagrantfile, you can set a bridged network if that fits with your VM and hosting setup, but the simplest networking setup is port-forwarding. A port on your virtual box, such as 80, is forwarded to an unused port on your host machine, from where it can be accessed:

```
config.vm.network “forwarded_port”, guest: 80, host: 8082
```

This in turn can be forwarded – for example, from Apache on the host machine – and/or matched there to the URL you want.



09 Shell

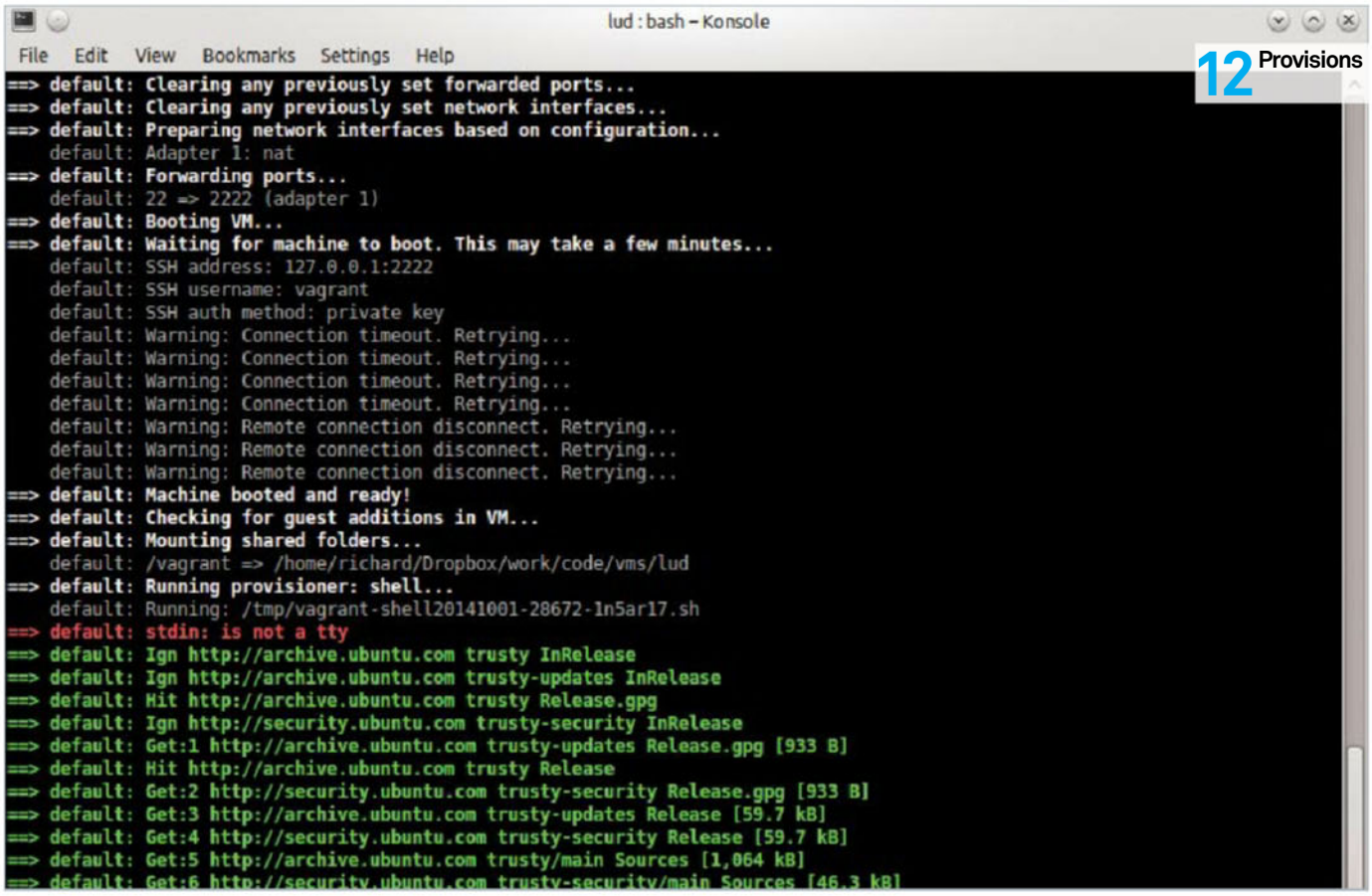
Changes to Vagrantfile can be applied to a running server with the vagrant reload command. While so much can be configured from outside your running server, vagrant ssh gives you all important access to the shell inside your virtual box Tiny Core, shown in the screenshot above, is great for quickly testing VBox, as opposed to using Ubuntu.

Don't forget to exit the ssh session before running any more vagrant commands. Vagrant suspend leaves the box a few seconds from readiness via another vagrant up. Vagrant destroy removes the virtual machine, but the Vagrantfile enables you to provision another that's exactly the same.

Puppet and Vagrant – part 1

Configure and deploy virtual boxes with Puppet and Vagrant

TUTORIAL

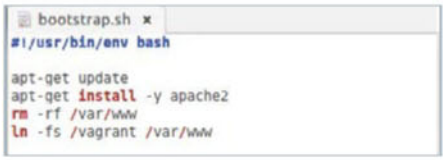


10 Shared files

Changes you make within a running box can be preserved; vagrant halt cleanly shuts down the box and saves disk contents. Added flexibility comes from being able to share files between the host and the virtual box.

By default, the directory from which you init the vagrant box is shared with that box. Take a look at /vagrant from within your ssh session – that Vagrantfile is the same one you were working on before.

More shared directories can be added by uncommenting config.vm.synced_folder in your Vagrantfile.



11 Bootstrap

Next month we're going to use Puppet to provision and maintain our virtual box, but we won't leave you hanging. Here's how to do it without Puppet, to get you going for now.

Create the file bootstrap.sh in the same directory as Vagrantfile. The canonical example (for a Debian or Ubuntu box) is:

```
#!/usr/bin/env bash

apt-get update
apt-get install -y apache2
rm -rf /var/www
ln -fs /vagrant /var/www
```

Note the linking of the web content to the directory shared outside the VM.

12 Provisions

The bootstrap.sh file is called by adding the following to Vagrantfile:

```
config.vm.provision :shell, path:
"bootstrap.sh"
```

... beneath the config.vm.box directive, and then using vagrant up --provision. Or, for an already created machine:

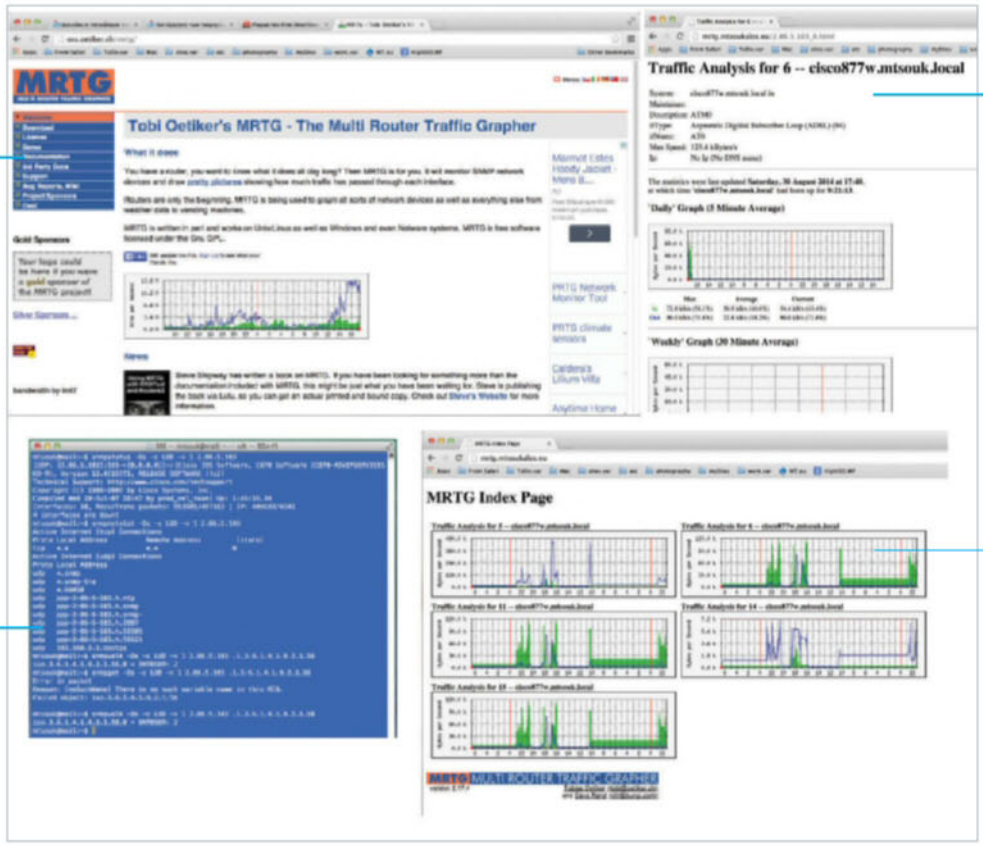
```
vagrant reload --provision
```

You'll see the output of the commands in bootstrap.sh on the terminal; expect a few warning messages but check through for anything unexpected.

Now, experiment with your bootstrap.sh file and perhaps different distro images. Next month we'll show how as our needs grow more complex, Puppet keeps things maintainable.

This is the MRTG website, where you can find news about MRTG as well as the latest version

The MRTG output for each network interface is similar to this



The SNMP server is using various SNMP commands to query a network device

MRTG has a utility that creates an index page based on a configuration file. You can click on each image to see more information

Advisor

Mihalis Tsoukalos is a UNIX administrator, a programmer (UNIX and iOS), a DBA and a mathematician. He has been using Linux since 1993. You can reach him on Twitter at @mactsouk and at www.mtsoukalos.eu

Resources

MRTG oss.oetiker.ch/mrtg

Cisco MIBs cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

SNMP RFCs bit.ly/1yACQ70

Cacti cacti.net

RRDtool oss.oetiker.ch/rrdtool

Monitor a Cisco router using MRTG

Use MRTG and its tools to monitor router traffic after setting up SNMP on Cisco IOS

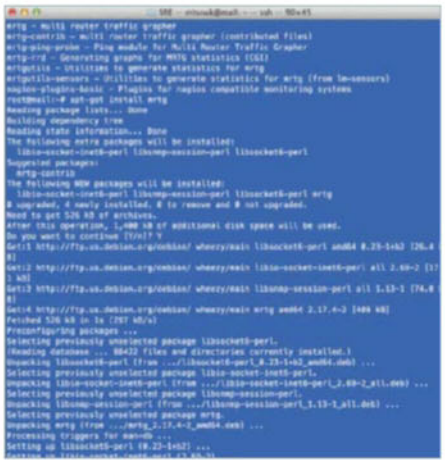
MRTG (Multi Router Traffic Grapher) is a tool for plotting free numerical data written in Perl by Tobi Oetiker. MRTG generates its output in HTML format and provides a live visual representation of the traffic load on network devices. MRTG is an essential tool for every system and network administrator and works with any device that supports SNMP. By viewing the output of MRTG you can quickly examine the traffic of an interface and make valuable decisions based on it.

This issue we will show you how to use MRTG to display the daily, weekly, monthly and yearly ADSL traffic of a Cisco 877W router with a little help from SNMP (Simple Network Management Protocol). You will need to access and configure your Cisco router and allow access to it from the Linux machine where MRTG will run.

Monitor a Cisco router using MRTG

Start using MRTG and its tools to monitor traffic loads

TUTORIAL

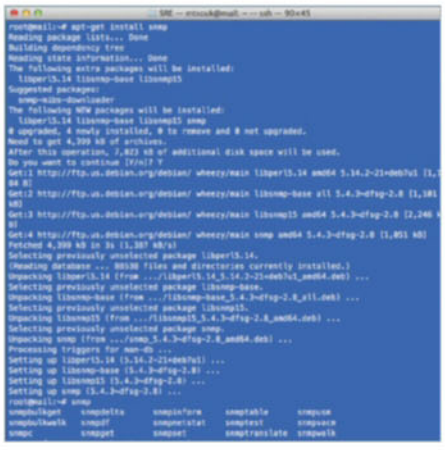


01 Install MRTG

Most Linux distributions have a ready-to-install MTRG package you can use. MRTG is a Perl script, therefore you can easily make changes to it if you want to modify something.

If you are going to run MRTG as the Apache user, which is recommended, you first need to do the following as root, provided that the Apache process is owned by the www-data user (adapt the command according to your Linux system):

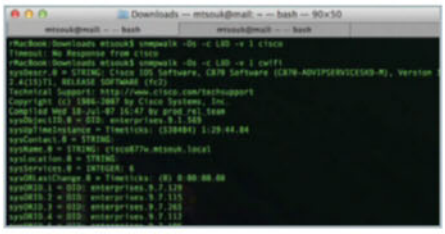
```
# chown www-data:root /var/lock/mrtg
```



02 About SNMP

SNMP is a known TCP/IP protocol that is available for most 'clever' devices, including Linux and other UNIX machines, routers, network switches, Windows machines and many others.

It provides statistics on the status of network interfaces, incoming and outgoing traffic, dropped datagrams and error messages, and it allows clients to access these statistics easily and remotely.



03 Useful SNMP commands

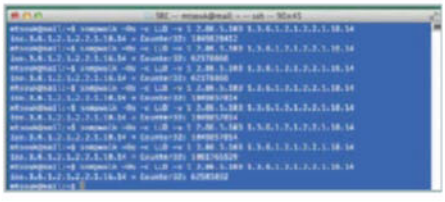
SNMP comes with many commands, including snmpbulkget, snmpdf, snmpset, snmptrap, snmpbulkwalk, snmpget, snmpstatus and snmpwalk. By far the most useful of them is the snmpwalk command that retrieves a subtree of values using SNMP GETNEXT requests.

If the community string name is wrong or the device does not currently support SNMP, the output of the snmpwalk command will look similar to the following:

```
$ snmpwalk -Os -c LUD -v 1 cwifi
Timeout: No Response from cwifi
```

04 Configure MRTG

Configuring MRTG can be the most difficult part of the whole process – especially when you are dealing with a non-standard network device, as you may have trouble finding the correct object identifier to query. Cisco routers are popular devices so setting up SNMP on a Cisco network device is a well-known process, but finding the correct object identifier can always be tricky.

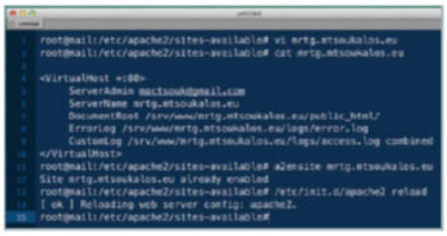


05 Cisco IOS

The first thing to do on the Cisco 877W ADSL router is to turn on SNMP and create an SNMP community string that will help you acquire the desired information. Cisco IOS has many cryptic commands, so type carefully.

The RO (read-only) community string (LUD) permits Get requests only, whereas an RW (read-write) community string – which is not needed here – allows both Get and Set requests. The following command, which produces many lines of output, will verify that the SNMP setup on a router named Cisco is working properly:

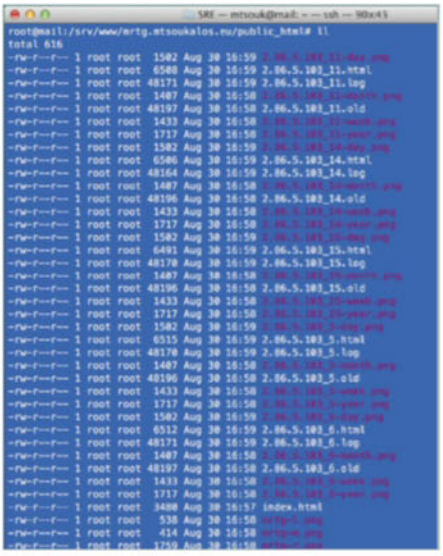
```
$ snmpwalk -Os -c LUD -v 1 cisco
```



06 Configure Apache

You should set up Apache so that you can see the static HTML output of MRTG not only locally but also from your network or the internet. You can do this by using a subdomain. The subdomain that will be used here is **mrtg.mtsoukalos.eu** – yours will vary – and it requires the addition of a new DNS entry. After configuring Apache, do not forget to enable the new site and make Apache use the new configuration:

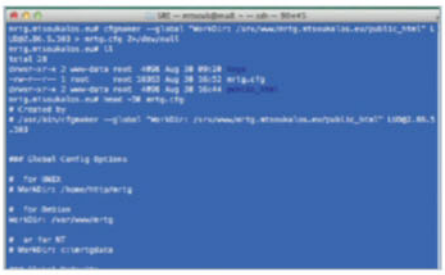
```
# a2ensite mrtg.mtsoukalos.eu
# /etc/init.d/apache2 reload
```



07 MRTG files and directories

One thing that you should carefully consider is the fact that the directory where MRTG keeps its files should have the necessary UNIX permissions in order to be read and written by the user that runs the MRTG Cron job.

The structure of the directory where MRTG keeps its files is pretty simple: it has just one directory with plenty of files corresponding to the supported interfaces and devices.



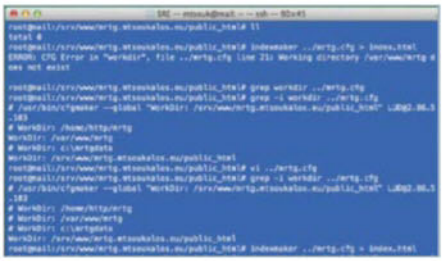
08 The cfgmaker utility

The cfgmaker MRTG utility is used for creating configuration files easily. It may add unnecessary data that you should clean up later, but what it creates is a great starting point. You usually run it as follows:

```
# cfgmaker --global "WorkDir /srv/www/mrtg.mtsoukalos.eu/public_html" LUD@2.86.5.103 > mrtg.cfg
```

This command creates mrtg.cfg in the current working directory, using the /srv/www/mrtg.mtsoukalos.eu/public_html directory for writing the output, and it queries a machine with the 2.86.5.103 IP address using the "LUD" community string.

The mrtg.cfg file automatically generated by cfgmaker is very busy, so you will have to spend some time cleaning it up to leave only the interfaces that really interest you.

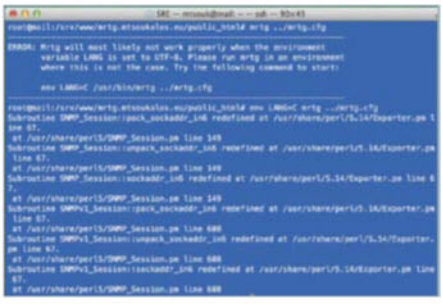


09 The indexmaker utility

After generating the MRTG configuration file using cfgmaker, you should create an index HTML page that will allow you to access the output of MRTG. This task can be done using the indexmaker utility, which also comes with the mrtg package, as follows:

```
$ indexmaker mrtg.cfg > index.html
```

Now you can point your browser to the right URL as defined in Apache or to a local file, depending on where you put MRTG's index.html file, to view mrtg's information. The image files haven't been created yet, so the output will look unpleasant.



10 Run MRTG

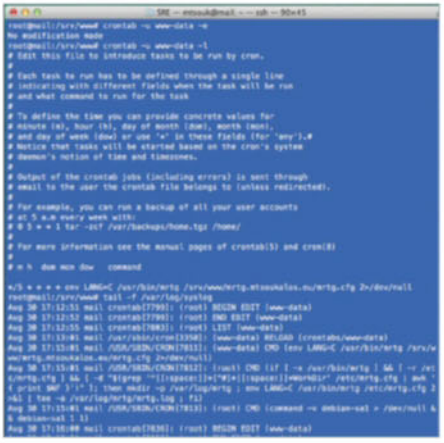
There are two ways of running MRTG, manually or as a Cron job. The first way is useful for testing and debugging purposes. The second way is the preferred way of running MRTG. It is best to run the MRTG Cron job as the user who owns the Apache process. The following command will reveal that user:

```
$ ps uaxf | grep -i apache
```

The first time you run it, you will see many errors and warning messages due to the fact that all output and data files were missing and MRTG had to create them all. If everything is fine, your next task will be to set up MRTG to run as a Cron job.

On a Debian 7 system the MRTG executable needs to run as follows, because MRTG will most likely not work properly when the environment variable LANG is set to UTF-8:

```
# env LANG=C mrtg ../mrtg.cfg
```

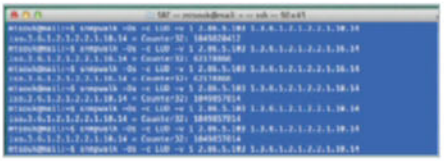


11 Configure Cron

Setting up Cron for the www-data user requires running the following command as root:

```
# crontab -u www-data -e
```

Cron is a reliable service, so once you see that MRTG runs fine as a Cron job you will not have any other problems. MRTG produces its HTML and images files in the directory that was defined when you ran the cfgmaker utility.



12 A closer look at the configuration file

The Cisco SNMP OIDs (object identifiers) of interest for the used device are 1.3.6.1.2.1.2.2.1.10.14, which returns the incoming traffic for the ADSL connection,

Tips

If it's possible, use an internal interface

Each ADSL router has two IP addresses: one for the internal network and one for the external. When possible, use the IP of the internal network to query your device because it is more secure and quicker.

Do not turn off your router

If the network device is turned off or is unreachable then MRTG will use the previous value until it can get a new one, so you are going to see straight lines on the output.

Security

Watching the output of MRTG can tell you many things about your network, so make it a habit to watch it. Seeing too much traffic during weekends or having strange peaks is a security warning that will need further investigation.

Log files contain data

MRTG names the files where it keeps its SNMP data with the .log extension. For example, for the cwifi device, the log file is called cwifi.log.

Test the maximum speed

It is considered a good practice to test the maximum speed of an ADSL router by downloading a big file and watching the output of MRTG.

Monitor a Cisco router using MRTG

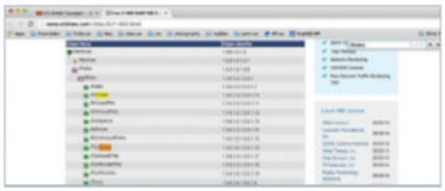
Start using MRTG and its tools to monitor traffic loads

TUTORIAL

and 1.3.6.1.2.1.2.2.1.16.14, which returns the outgoing traffic for the ADSL connection. In the next step you will learn how to find them for yourself.

In order to make mrtg track those two values you may need to manually make changes to the Target[] line of the MRTG configuration file.

The final version of the mrtg.cfg file that supports just a Cisco router named cwifi with IP 2.86.19.123 can be found in **Fig 01**.

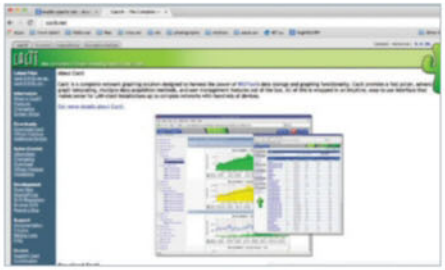


13 Cisco SNMP object identifiers

Finding the correct OIDS is not always easy, and sometimes you may need to read your router's documentation carefully or contact the manufacturer. The Wi-Fi connection was automatically found by the cfgmaker utility but setting up the ADSL part was trickier. To find out your own OIDs, you will need to go to **http://www.oidview.com/mibs/0/IF-MIB.html** (search Google for "IF MIB download"). Next, you should look for In and Out Octets. Then add the desired Cisco interface number at the end of each sequence. The available interfaces of a Cisco device can be found by executing the following IOS command:

```
cisco877w# show snmp mib ifmib ifindex
```

The interface we wanted was called Dialer1 and its index number was 14, but yours may vary.



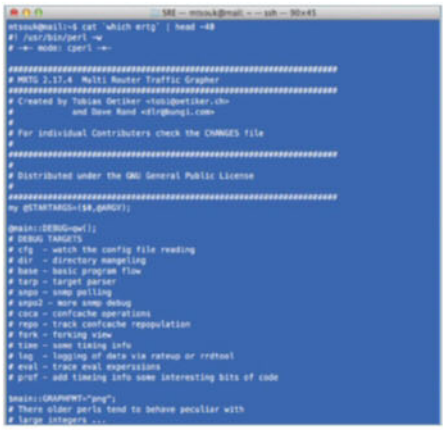
14 About Cacti

An alternative to MRTG is called Cacti. Cacti is also an open source network graphing application that supports plugins and utilises RRDtool, which is a data logging and graphing system for time series data. Cacti plugins allow developers to generate additional Cacti features without dealing with Cacti's source code.

Fig 01

```
EnableIPv6: no
WorkDir: /srv/www/mrtg.mtsoukalos.eu/public_html
Target[cwifi]: 1.3.6.1.2.1.2.2.1.10.14&1.3.6.1.2.1.2.2.1.16.14:LUD@2.86.19.123:
SetEnv[cwifi]: MRTG_INT_IP="192.168.2.1" MRTG_INT_DESCR="ADSL"
MaxBytes[cwifi]: 475000
Title[cwifi]: Traffic Analysis for 14 -- cisco877w.mtsouk.local
PageTop[cwifi]: <h1>Traffic Analysis for 5 -- cisco877w.mtsouk.local</h1>
    <div id="sysdetails">
        <table>
            <tr>
                <td>System:</td><td>cisco877w.mtsouk.local in </td>
            </tr>
            <tr>
                <td>Maintainer:</td><td>Mihalis Tsoukalos</td>
            </tr>
            <tr>
                <td>Description:</td><td>ADSL connection</td>
            </tr>
            <tr>
                <td>ifType:</td><td>ADSL model</td>
            </tr>
            <tr>
                <td>ifName:</td><td>Dialer</td>
            </tr>
            <tr>
                <td>Max Speed:</td><td>475.0 kBytes/s</td>
            </tr>
            <tr>
                <td>Ip:</td><td>2.86.19.123 (No DNS name)</td>
            </tr>
        </table>
    </div>
```

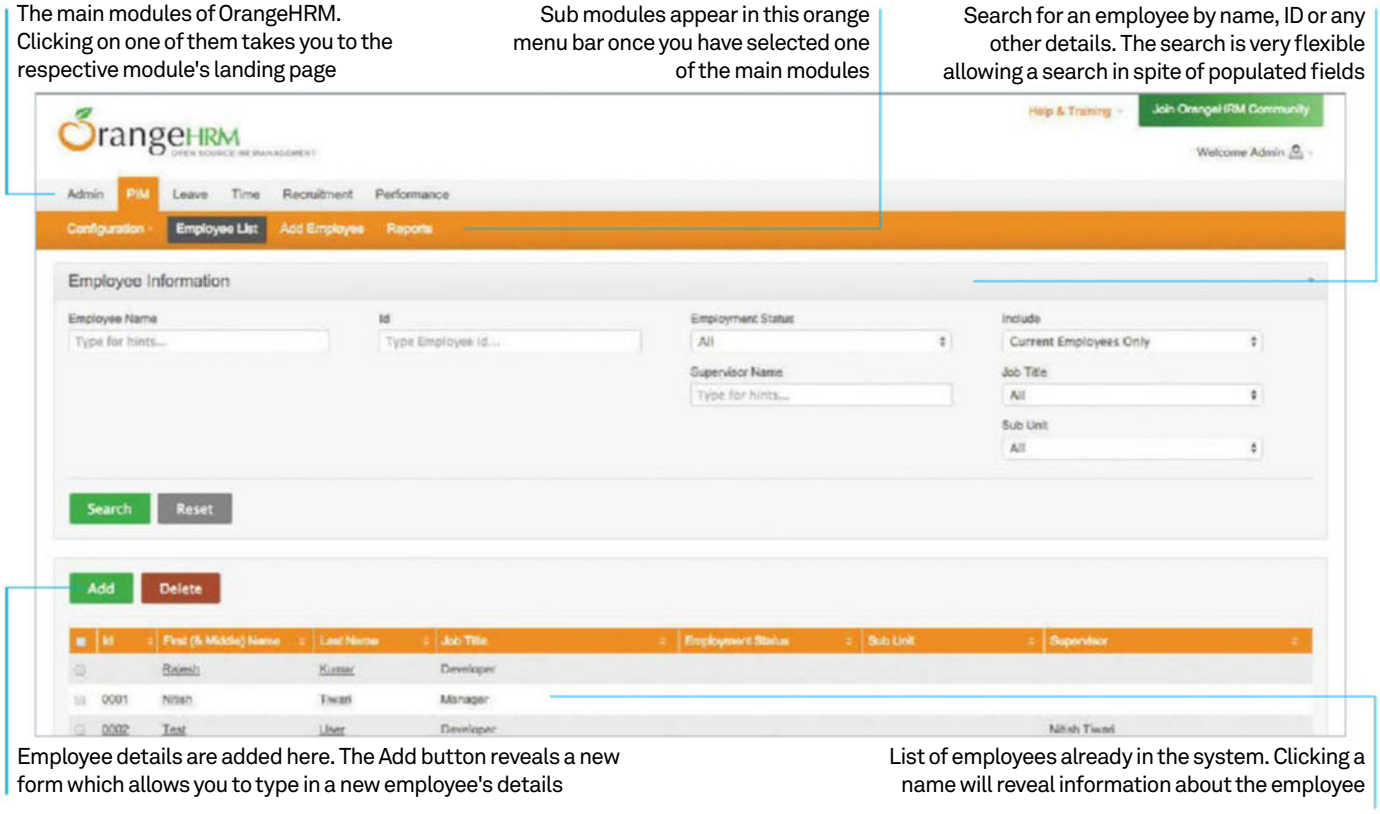
> **Once you see that MRTG runs fine as a Cron job, you will not have any other problems**



15 Final thoughts

MRTG is easy to configure but does not support plugins. On the other hand, Cacti is a more powerful and capable tool but, in order to harness its full potential, you will need to experiment with it. Cacti will be the topic of a forthcoming article where you can compare it with MRTG and decide which one is better for your needs.

I strongly recommend learning both Cacti and MRTG in order to be able to use the right tool for the job.



Simplify HR management with OrangeHRM

Employees are the most important part of any organisation and management tools are essential in maintaining efficiency

Advisor

Nitish Tiwari is a software developer by profession and an open source enthusiast by heart. As well as writing for a leading open source magazines, he helps firms set up and use open source software for their business needs.

Resources

OrangeHRM www.orangehrm.com

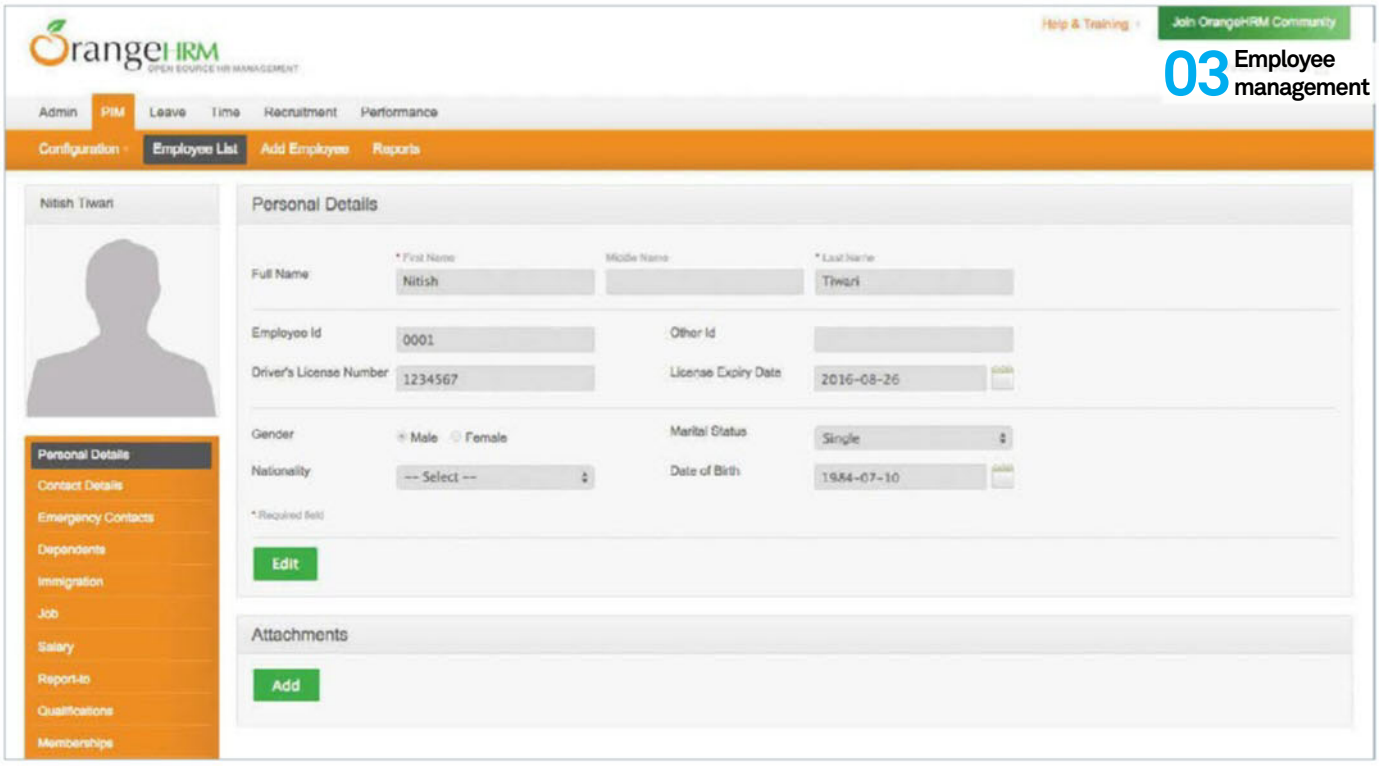
For any organisation, whether a small one with few employees or a multinational corporation with several branches worldwide, managing human resources is always an important but difficult task. It is important because the employer needs to track key metrics and strategise accordingly to keep the employees in good spirits. It's also difficult because HR management is a diverse field with so many things to be managed; leaves of absences, performance, logged hours, employee profiles, salaries and a lot more. While organisations are now increasingly becoming aware of employee needs, leaving no stone unturned in making sure employees remain happy, the hunt for a great HRM tool sometimes proves to be the difficult part.

In this tutorial we will have a look at one of the most renowned and popular open source HR management tools – OrangeHRM. With the first beta release in 2006, it has continuously grown and is now used by one million users worldwide. OrangeHRM supports all the important aspects of HR management and is ridiculously easy to deploy and use. Given the ease of installation, configuration and use – and robustness – it is useful for all types of organisations, from startups to multinationals. In this tutorial we have used the stable release version 3.1.2.

Simplify HR management with OrangeHRM

Maintain your company's efficiency with the open source management tool

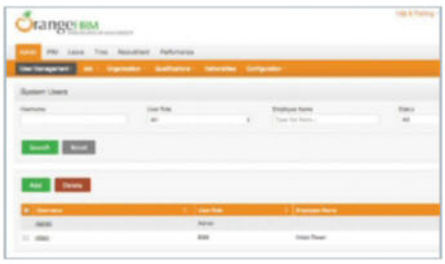
TUTORIAL



03 Employee management

01 Installation

For Linux (and OS X) the source code is available for download as a ZIP file. Once you download it, just unzip and place the contents in the root folder of your webserver. You will need webserver and database preinstalled though – a LAMP/MAMP server, for example. If you also need to set up OrangeHRM on a Windows system, a bundled installer is available – complete with web server and database. Once you've downloaded and unpacked everything that you need, access the folder via a web browser – the URL should be something like: **http://localhost/orangehrm**. If everything is fine, the set-up wizard welcomes you with an option to freshly install OrangeHRM or upgrade existing set up. As you proceed for fresh installation, you will need to provide the database root access (if the database for OrangeHRM is not created) or just the details of database already created for OrangeHRM. You can then create the admin user ID and password. Finally, you have the optional registration before the installation finishes.

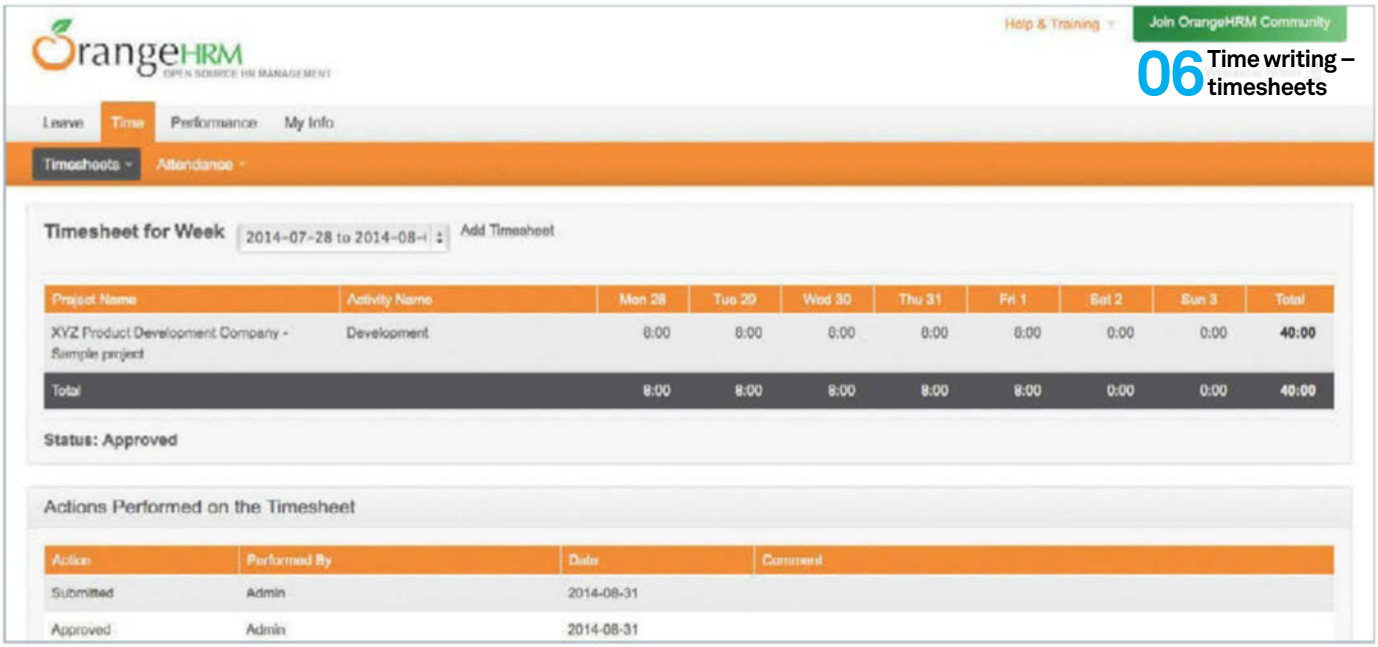


02 Administration and configuration

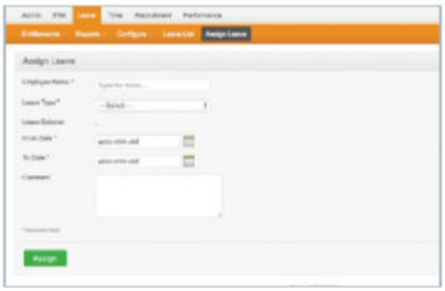
As you log in as an admin you can see several tabs corresponding to different functional areas. Under the Admin tab, you have the User Management, Job, Organisation, Qualifications, Nationalities and Configuration sections. You can set shift hours under the Job section. Employee qualifications can be set under Qualifications. Configuration lets you enable/disable different modules, configure email using sendmail or SMTP, and subscribe users to email notifications. While the other sections names are self-explanatory, there are few important tips you will find useful – User Management corresponds to the system users, and so you can't directly add a user. You will need to add the employee first (more about that in the next step) and they can then be added as a system user under the User Management section. A user can have only two roles: ESS (employee self service) and admin. Roles are not to be confused with job titles; there can be several job titles (which can be created under the job section).

03 Employee management

The PIM, or Personal Information Management, section is the place where you can manage the employees' data. Click on the Add Employee link and just fill the relevant details. If you select Create Login Details, a system user for the employee is created as well. Otherwise you can add employees as system users through the user management option under Admin tab. You may think that the fields for employee details are too few to capture all the details, but as you click Save after filling the details, you can see the full view of the employee details page. This page lets you view and modify all the details related to an employee like personal details, contact info, dependents, salary, organisational hierarchy and much more. You can also add custom fields under employee details page – just go to the Configuration tab under the PIM section and click Custom Fields. There are a few option fields available as well.



06 Time writing – timesheets



04 Leave management

The next section is the Leave section. When you go to the Leave tab, new subsections are visible: Entitlements, Reports, Configuration, Leave List and Leave Assignment. To set up Leaves, you can start with the Configuration tab. Here you can create leave types (like sick, casual and more), list out holidays for the year, configure working days of the week and set the leave period (one year durations with leave entitlements are valid). After Configuration, you can then head over to the Entitlements section; this is the place to add leave entitlement to employees. Based on these entitlements and corresponding leave balances, employees can then apply their leaves. The Leave List section shows the leave data for the total leave period. The Assign Leave section allows the admin to grant leave without the employee applying for it.

05 Time writing – attendance

Attendance tracking is a very sensitive issue; even a small error in logging the in and out times can cause big problems (at least for the reputation of an employee). OrangeHRM provides a neat way to track the attendance. Just head over to the Time tab and you can see the Attendance section inside. Here you can view employee attendance records or configure things like whether or not an employee or supervisor can modify the attendance records. Note that you're currently logged in as admin, but to log attendance then you should be logged in to the system as an ESS user. Just make a user with the ESS role and log in. After that, just go to Time>Attendance>Punch in/out and click In. The system automatically logs the date and time. The page refreshes to show the Out option now.

06 Time writing – timesheets

While attendance is used to track the actual hours spent in office, timesheets generally track the time spent on various activities inside the office, and the data is used for budgeting purposes. So before adding timesheets, you need to add customers and corresponding projects. Also, with each project the related activities should be added. To add these details, head over to Time>Project Info>Customers. After adding the customer, add projects using the Project link just below Customers – activities can also be added in the same page. Now you are ready to add timesheets. As an admin, you can add or view the timesheets of all the employees just by going to Time>Timesheets>Employee Timesheets. This page also shows the submitted timesheets, which have actions pending from your end. An ESS user can add and edit her timesheets using their own login.

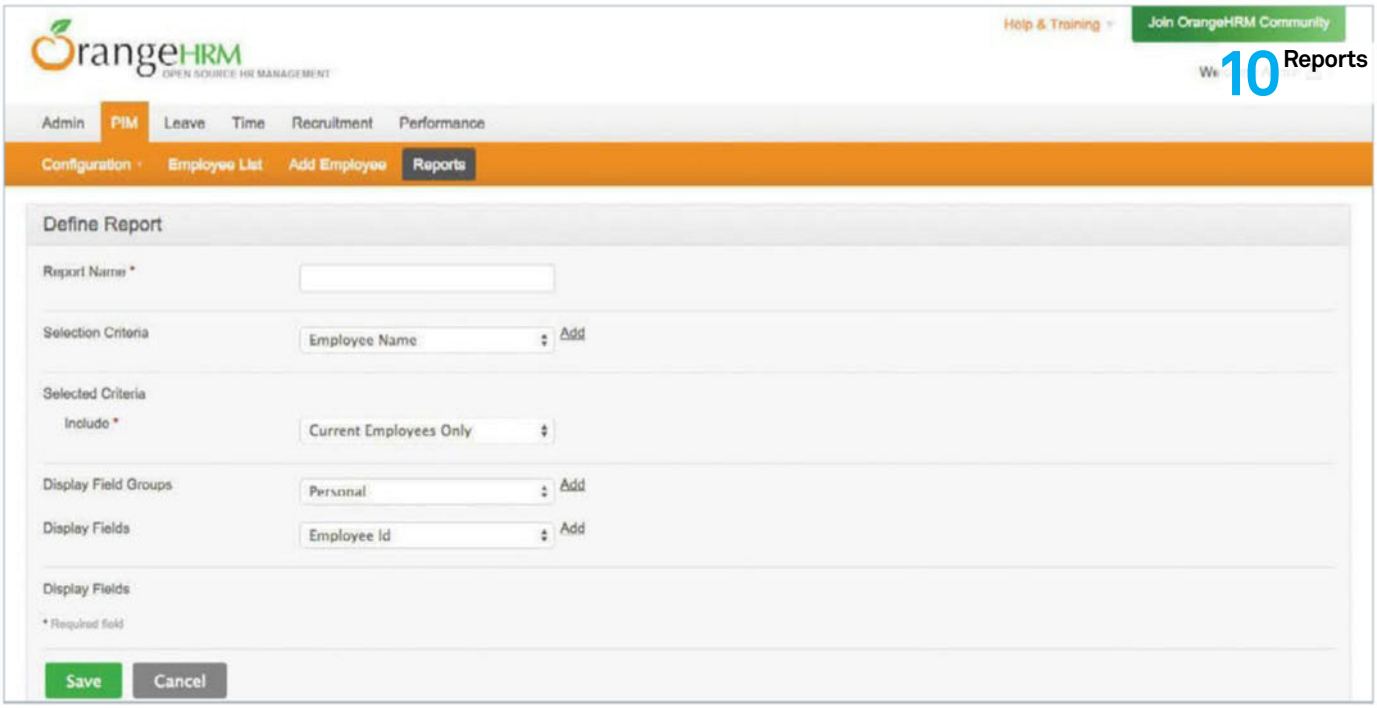
07 Performance management – employer

In this section we will have a look at how to set up performance management using the admin interface. The performance management in OrangeHRM is based on KPIs, ie the key performance indicators. For every job title in the organisation, the corresponding KPIs, along with the maximum and minimum rating points, need to be created. Every employee can then be automatically evaluated based on the KPI of their job title. To set KPI go to Performance>Add KPI. You can select the job title and then add the KPI; the maximum and minimum ratings are optional but should be added to ensure uniformity in

Simplify HR management with OrangeHRM

Maintain your company's efficiency with the open source management tool

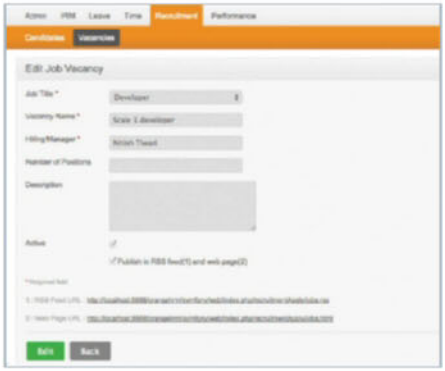
TUTORIAL



ratings. You can check all the KPIs added in the KPI List page. After adding the KPI you need to go to the Add Review page to initiate the review process for an employee. In the next section we see how it all looks to the employees.

08 Performance management - employee

After the review process is initiated by the admin, the reviewer and the reviewee can view it under Performance>Reviews link. Only the reviewer can open it though, to add their reviews. After the reviewer adds reviews and ratings, and submits the form, the admin then needs to approve the review before it is made available to the employee. Once the admin approves the review, no further changes can be done – even by the admin. Note that the reviewer for an employee is completely independent of the organisational hierarchy, so anyone from the employee pool can be added as a reviewer for the employee.

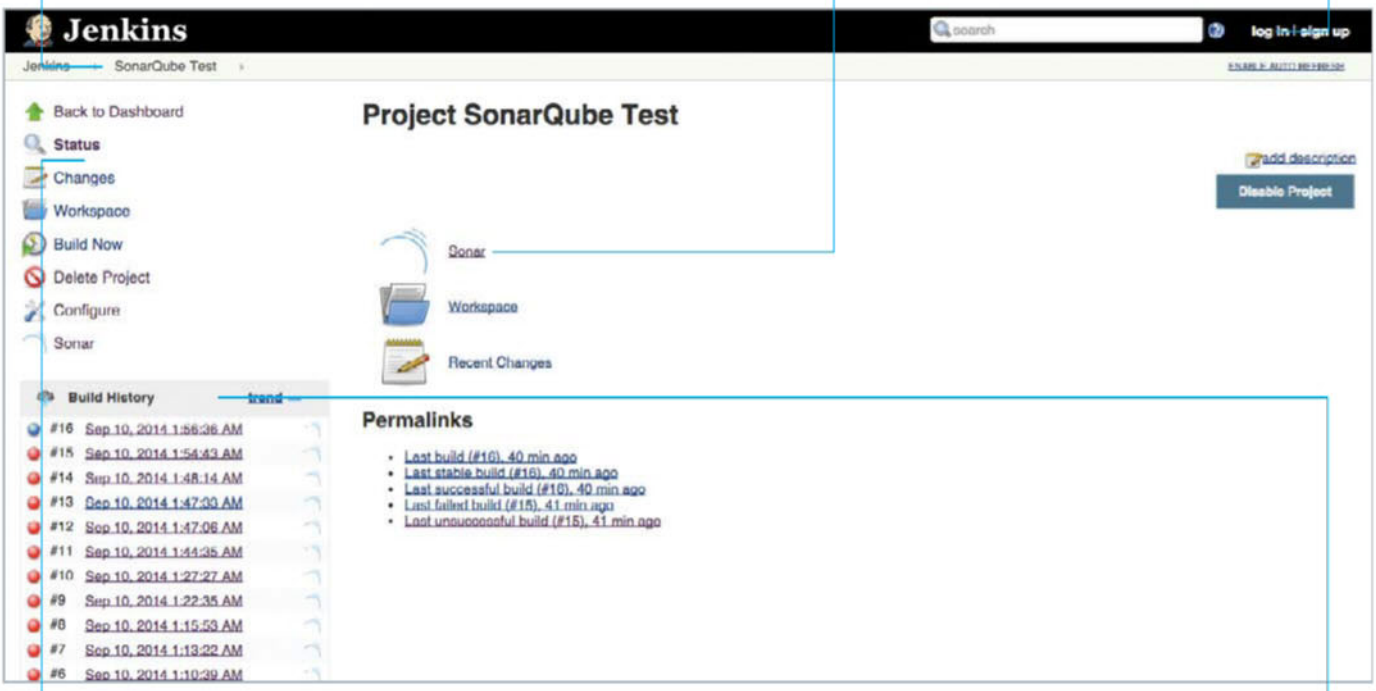


09 Recruitment

OrangeHRM lets you manage the recruitment process as well. From publishing a vacancy to handling job applications to shortlisting and hiring – you can do it all with OrangeHRM. Let's see how to get started. Click on the link Recruitment>Vacancies, this is the page where you can add the vacancies. As a vacancy is created, a web link and a RSS feed is created, which is available publicly. This link not only has the full vacancy details but also allows candidates to apply via a form. Later, as someone applies, the candidate page (next to vacancy link) automatically gets updated with the details. You can then click on the candidate name to manage the application. The application goes through the steps of shortlisting, scheduling interviews, interview results, offering the job and, finally, hiring. After you hire the candidate, the employee entry for the candidate is created automatically. You would need to manually create the login for the new employee though.

10 Reports

Several modules of OrangeHRM have the option to generate reports. Let's have a closer look at what each one of them has to offer. In the PIM section, the Reports tab lets you create custom reports which once created can be saved and used later. As you click on Reports the Define Reports page appears. Here you can create reports related to employee data such as employee's name, grade, job title, education and so on. The Leave section allows you to generate reports related to leave entitlements and leave usage. There are no custom reports here though, only a fixed set of reports. The Time section also has its own set of fixed reports. Project Reports shows the time spent on a project and its activities by all the employees, whereas Employee Reports shows the time spent by an individual employee, categorised by different projects and activities. Then while the first two are related to timesheets, Attendance Summary lets you see the attendance details of an employee.



Continuous code analysis with Jenkins & SonarQube – part 1

Advisor

Nitish Tiwari is a software developer by profession and an open source enthusiast by heart. As well as writing for leading open source magazines, he helps firms set up and use open source software for their business needs.

Resources

SonarQube stable release and SonarQube Runner
www.sonarqube.org/downloads

Jenkins
www.jenkins-ci.org

Jenkins plugins
https://wiki.jenkins-ci.org/display/JENKINS/Plugins

Learn how to run SonarQube code analysis automatically with the Jenkins continuous integration server

Some time back in issue 139 of Linux User & Developer we ran a tutorial on how to set up SonarQube to analyse a Python project. While SonarQube in itself is a great static code analyser, you still need to manually run it every time to get the results. This is a big problem, regardless of whether you are in a small or large team of developers, because generally speaking, no one is free to do it. Jenkins is the solution.

It is a continuous integration server that can automatically build your code, execute tests, send you the results and much more besides. Jenkins can also be configured easily to trigger SonarQube code analysis. We did briefly touch on the topic of combining Jenkins and SonarQube towards the end of the earlier tutorial, but in this tutorial we will explain Jenkins installation and its basics followed by a brief revisit to SonarQube.

Later, you will find out how to configure Jenkins with the SonarQube plugin to trigger a code analysis. Finally, we will also introduce a few of the important Jenkins plugins, which can help you to work smarter. We've used the latest Jenkins revision 1.579 and SonarQube revision 3.7.4 for demo purposes in this tutorial.

Continuous code analysis – part 1

Set up a Jenkins integration server ready for SonarQube analysis

TUTORIAL

01 Jenkins installation

Jenkins is available for download as a WAR file that can be dropped into your favorite JEE container or can be executed directly with a **java -jar jenkins.war** command. Note that JDK and JRE are prerequisites for Jenkins. If you'd rather not go deep into the details, you can also download the native package for your operating system. These packages contain the WAR file and the other dependencies required all together. You just have to download and install them like any other application. As soon as the installation completes, Jenkins is accessible at **http://localhost:8080/**. Note that there is no admin (or any other) user created because anyone can access anything. This will change only after Jenkins' security is set up, which is what we're going to take a look at next.

02 Get started with Jenkins

To set up security, go to Manage Jenkins>Configure Global Security and click on the Enable Security checkbox. The security settings will open up and here you can select the ports, on which other slaves can connect with Jenkins; the security realm, ie the user authentication method using LDAP; the Unix user group, Jenkins DB and more, and also the user authorisation (or in other words, the user permissions). Adding users depends on the security realm you select here. If you use the Jenkins database, an option to manage users in the Manage Jenkins page comes up automatically. Go to this page and click on the Create User link to add users. You may want to configure privileges and access levels for different users as you begin to add them. This can be done by heading across to Manage Jenkins>Configure Global Security>Access control>Authorisation>Matrix-based security.

Note that if you lock yourself out of Jenkins accidently, you can simply open up the /var/lib/Jenkins/config.xml file and set the <useSecurity> element to false, and also remove the authorizationStrategy and securityRealm elements from the file. Save the file, restart Jenkins and you should be able to work.

03 Jenkins jobs

As a continuous integration server, Jenkins can take source code directly from your file system or even source code management system and then build it. This, along with pre- and post-build options and other features, enables you to experiment and configure tasks exactly as you need them. The various project builds/jobs supported by Jenkins are:

Freestyle software build

It lets you use any SCM combined with any build process. You can also run shell/batch scripts, invoke and more while building the software. If you are not sure about the build type while setting up Jenkins, you should probably use this.

Maven

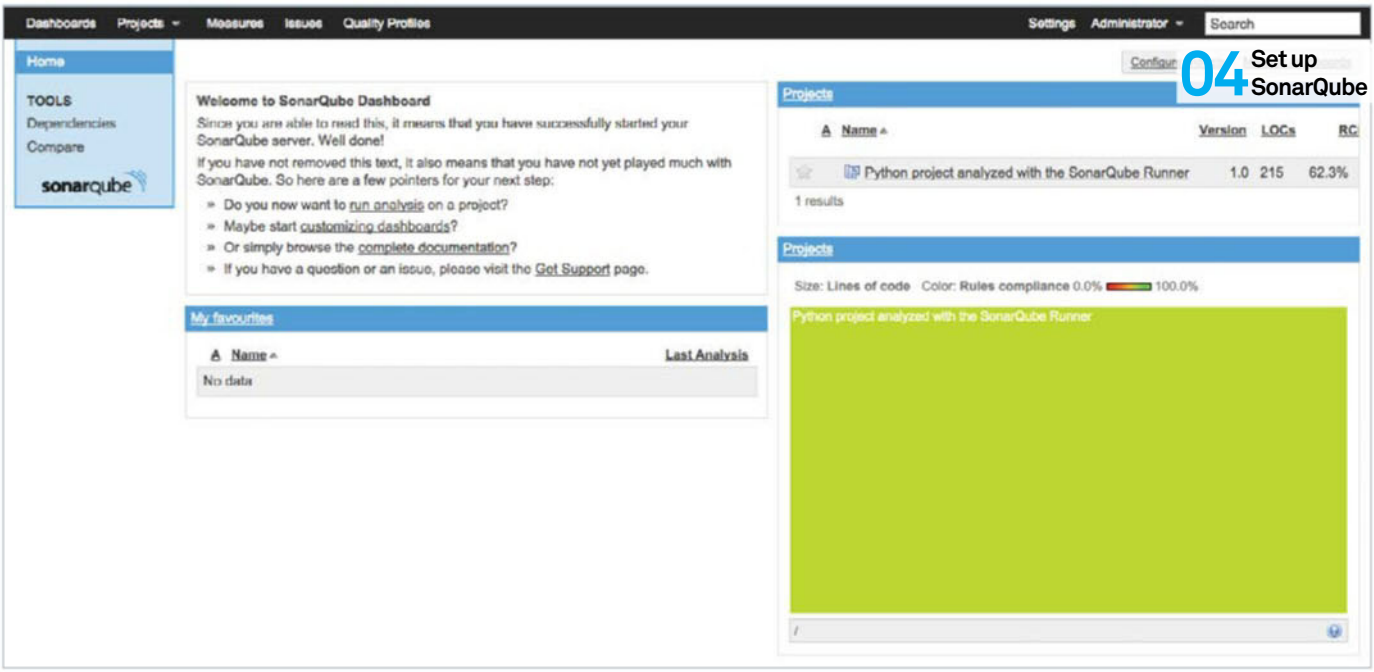
Two-thirds of projects are specific to Maven projects and they analyse the **pom.xml** file in great details.

Multi-configuration project

This will let you set up projects which may need more than one configuration, for example builds which are specific to different platforms. This is quite similar to the freestyle software build with an addition of configuration matrix which helps you set up different configurations.

Monitor an external job

Jenkins can be used as a dashboard to monitor jobs run on external systems using this option. However, it may not be available by default, in which case you'll need to enable the external-monitor-plugin under the plugins page.



04 Set up SonarQube

04 Set up SonarQube

Now that Jenkins is set up and you have a basic idea of what it's capable of, let's revisit SonarQube. SonarQube is comprised of three major components: the application source code hosted on a webserver, a database and the analyser. All three are logically separated and generally need to be installed separately. It's the analyser that actually interacts with the source code to be analysed and saves the results to database. The SonarQube web interface then shows you the results. There are different analysers available for different project types. We will analyse a non-Maven Python project for demo using the SonarQube Runner. You can download it from the SonarQube website. Setting up the analyser requires editing the sonar-runner.properties file for database connection strings and credentials. If you get stuck, look up the first SonarQube tutorial: **www.linuxuser.co.uk/tutorials/analyse-code-with-sonarqube**.

05 Install SonarQube plugin in Jenkins

The plugin in question here is a Jenkins plugin, which enables it to connect to the SonarQube installation (specifically, the SonarQube analyser). After the connection is done, Jenkins can trigger the analyser based on predefined criteria. To install the plugin, open your Jenkins homepage and go to the Manage Jenkins>Manage Plugins page and click on the Available tab. Then search for 'sonar' in the filter box. As you type, you will see the Sonar plugin. Select the checkbox in front of it and click the 'Install without restart' button. Jenkins then starts the installation process, beginning with a network check and plugin download. Soon after, if everything is fine, the plugin gets installed. It needs to be configured now.

06 Plugin in action

To configure the plugin, go to the Manage Jenkins>Configure System and scroll down to the Sonar tab. Here you will need to fill in the name (SonarQube), its database credentials and other details. After filling this in, scroll up to the Sonar Runner tab and then fill in the Sonar Runner details here. This completes the setup. After the plugin is set up, go to the Jenkins homepage and create a new project. You can do this via the New Item link on the left, selecting 'Freestyle project' as the project type. In the configuration page that appears now, scroll down to the Build tab and select 'Invoke Standalone Sonar Analysis' in the 'Add build step' drop-down menu. Fill in the path of your project's properties file (the same file required by SonarQube Runner to analyse a project). You can also select the trigger for building the project in the Build Triggers tab, just above the Build tab. This completes the process – now, as per your settings, Jenkins will automatically trigger the SonarQube analysis. To view it, you just need to log in to SonarQube and the latest code quality metrics will be available to you.

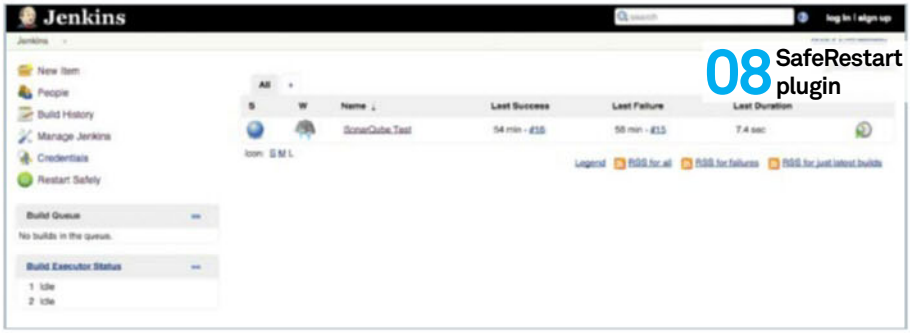
> **"Jenkins generally needs a restart after any configuration changes or after any plugin installations"**

07 Job Config History plugin

This plugin is especially helpful for people who are new to Jenkins, though people with some experience on Jenkins may also find it useful. Let's consider a scenario – your Jenkins build works fine, then you think of making further improvements and start changing the settings, and suddenly everything stops working. But you don't even remember the last change you made! Well, JobConfigHistory plugin is there to bail you out of such situations. It saves the config.xml after each change you make in Jenkins settings. You can just check the file differences and make necessary amends.

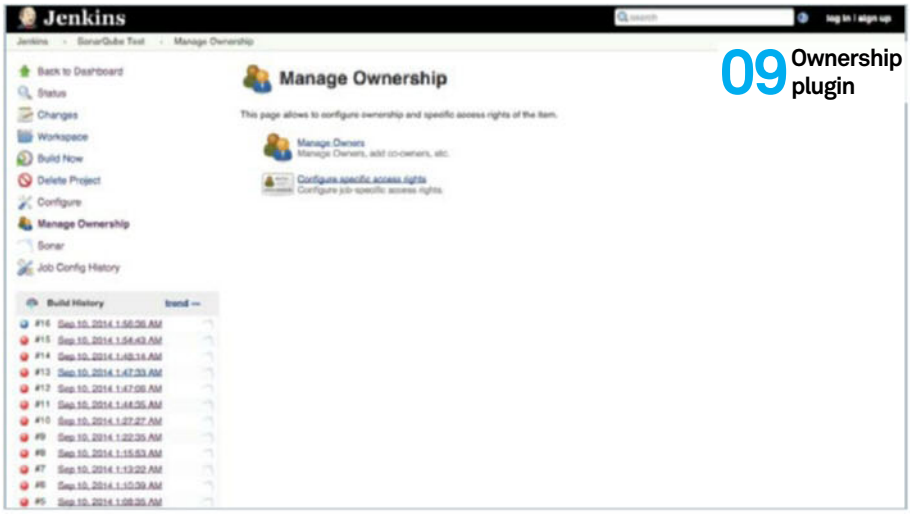
08 SafeRestart plugin

Jenkins generally needs a restart after any configuration changes or after any plugin installations. But being a server-client-based application with multiple concurrent users executing their jobs, you need to be extra careful since you may accidently abort someone else's build during a restart. The SafeRestart plugin frees you from worrying about ths. Once you click the 'Restart Safely' button (that appears in the left menu bar after you install the plugin) it schedules a restart once all the builds are done.



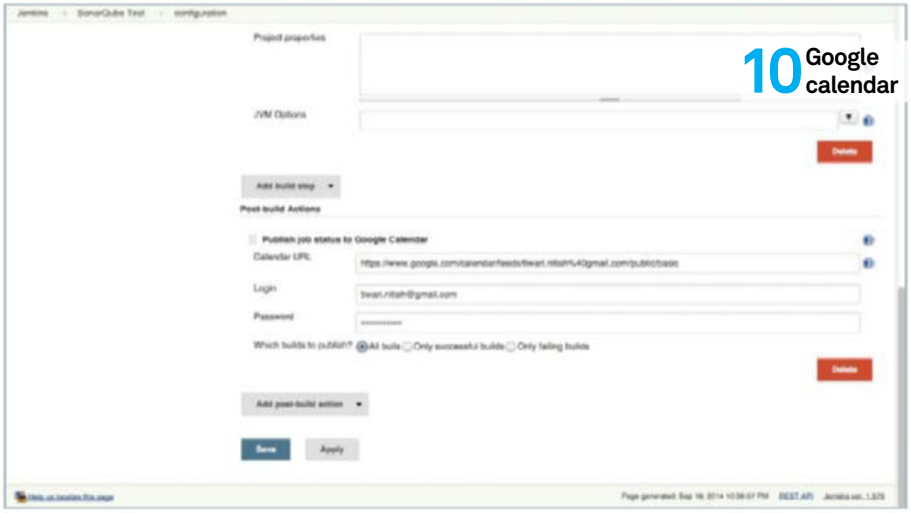
09 Ownership plugin

As the name suggests, this plugin lets you assign explicit ownership for jobs and slave nodes. Introducing ownership means better responsibility management and faster resolution of issues... unless it turns into pointing fingers! On a serious note though, this plugin definitely offers a good way to handles issues – after a job fails you don't need to find someone to fix it. After you install this plugin, you get a link on the left menu bar called Manage Ownership (when inside a project). Here you can configure the owners/co-owners of a respective job.



10 Google Calendar and compress artefact plugin

The Google Calendar plugin allows you to publish build records to Google Calendar. After you install the plugin, you can view the option to publish build status to Google Calendar in the postbuild actions tab. A form appears as you select it and you then need the calendar URL and your credentials to fill it. After that, Jenkins automatically pushes the build results to your Google Calendar. Simple and effective! If you plan to save the build artifacts such as the test logs and build files after each build, you may find this plugin useful. This plugin compresses the artifacts before saving them to the disk, thus saving the disk space for you.



Model data using Qt

Handling a dozen items is not a problem. Increase this number to a few hundred, though, and problems can arise

Advisor

Tam Hanna has been in the IT business since the days of the Palm IIIc. Serving as journalist, tutor, speaker and author of scientific books, he has seen every aspect of the mobile market more than once

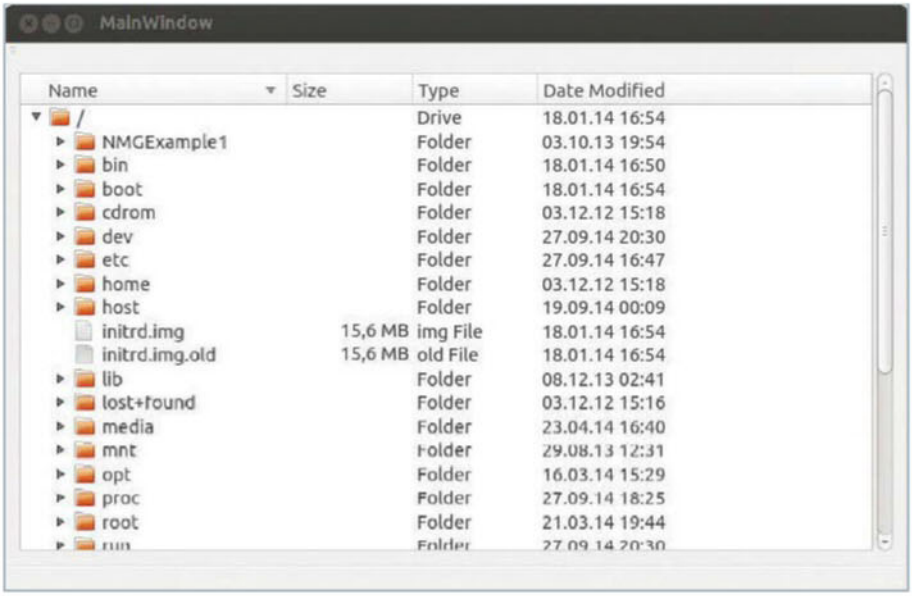
Even though there is no law which prevents you from trying your hand at such a program, consider yourself informed that a large variety of amusing problems will occur. First of all, prepare to accommodate your users to an ultra-slow and permanently-refreshing user interface. Keeping large amounts of data in the stores of list and table widgets is a sure-fire way to solicit angry calls from users bored to death by the slowness of your code.

If this is not enough to deter you, consider yourself informed now that you should accommodate yourself with all kinds of weird problems in relationship to data management. Filtering or sorting the records displayed will turn into a truly Herculean task.

Fortunately, Qt provides a highly efficient way to work around this problem. Many years ago, a programming language called Smalltalk introduced the world to the concept of the Model-View-Controller design pattern. A framework adhering to this standard provides its users with special classes which will encapsulate data storage.

Display is then accomplished by connecting them to a view. Your business logic can proceed to changing the information shown on-screen without concerning yourself of the tedious task of updating the widget's internal data store.

With Qt, using models is especially rewarding. The framework comes preloaded with a large variety of classes that can display all kinds of useful data.



Above Our data model provides file system information to the treeview

Let us start out by creating a little application that shows the file system of the host computer in a treeview. Open Qt Creator and use the New Project wizard to build a new project based on Qt Widgets. Double-click mainwindow.ui in order to make Qt Creator open the form in the user interface designer.

Look at the left of the screen. Your toolbox should contain two groups of controls which are dedicated to displaying lists and other information: item views and item widgets. Item widgets provide an 'embedded' storage for the items, whereas views must be connected to models in order to function properly.

File system made easy

Developers seeking to get started with a new programming language eventually end up writing a parser for the file system of their target platform of choice. This exercise is of superior didactical value, which is why we took you through it a few issues ago.

Introducing models makes the situation a lot easier. Grab a 'Treeview' widget from the toolbox and drag it into the middle of the form. Then, open mainwindow.cpp and change the form's initialisation method so that it looks like the code in Fig. 01.

We start out by invoking the setupUi method which is located in the ui object. It was created by a tool called uic (User Interface Compiler), and it acts as a 'broker' between our application as well as the code generated from the UI file.

In the next step, a new instance of QFileSystemModel is created. By making it a child of the form, we ensure that the parent-child system will remove the instance if the user decides to close the window in question. Calling setRootPath informs the model that it is to process a specific path.

Model-View-Controller

Breaking down large systems

Arranging systems according to predefined steps helps new developers get up to speed faster. This is accomplished via a group of architectures which are now known as design patterns. The Model-View-Controller pattern is among the oldest – it was introduced in a time when the word design pattern itself had not yet been formed.

MVC-based applications are made up of three parts. The model contains the actual data which is to be used and managed. Most implementations also place the business logic inside it. Changes occurring in the model can be pushed out to 'interested observers'.

Model data is rendered and displayed in views. A view knows about the controller and the model supplying it with information, but does not, usually, contain any kind of logic for handling user input. While views tend to be responsible for the actual rendering, they usually do not work with the data (for filtering, etc).

Controllers act as 'glue' between the two aforementioned objects. They tend to be responsible for filtering and sorting, and furthermore handle user input. Some implementations share the burden of input handling between the controller and the model: if the latter contains the business logic, duplication would occur if all input must be processed in the controller.

Fig 01

```
#include <QFileSystemModel>

MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);

    QFileSystemModel* myModel=new QFileSystemModel(this);
    myModel->setRootPath("/");
    ui->treeView->setModel(myModel);
}
```

Fig 02

```
MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);
    QFileSystemModel* myModel=new QFileSystemModel(this);
    myModel->setRootPath("/");
    QStringList *myStringList=new QStringList();
    myStringList->append("*.jpg");
    myStringList->append("*.jpeg");
    myModel->setNameFilters(*myStringList);
    myModel->setNameFilterDisables(false);
    ui->treeView->setModel(myModel);
}
```

Fig 03

```
#include <QModelIndex>

class MainWindow : public QMainWindow
{
    Q_OBJECT
    public slots:
        void itemDoubleClicked(QModelIndex _anIndex);
        . . .
```

With that, the model is ready to be assigned to the view. This is accomplished by calling the setModel method of treeview. Feel free to run the app in its current state – when running on a *nix operating system the tree will display an expandable list of the files and folders found on your machine.

In fact, QFileSystemModel even handles multithreading for you. File system traversal is handled by a background thread which pushes results to the GUI. Sadly, this means that the data stored in the code behind can not be accessed immediately – you should wait until the rowCount() property stops returning to zero.

Putting models to work

Even though displaying the contents of the file system is not a small feat by any means, our QFileSystemModel is able to accomplish much more. As an example, let us add a name filter which ensures that the tree contains only JPG files.

This can be accomplished by modifying the constructor of the main form once again. The new version of the method looks like the example in **Fig. 02**.

QStringList is a framework-provided helper class dedicated to the management of a group of strings. Our example code creates an empty instance and proceeds to add two strings containing regular expressions to it. The resulting convolute is then passed into setNameFilters, where it is used for parameterising the traversal function. Setting setNameFilterDisables to false ensures that results which do not match the patterns are not displayed – passing true would make them appear in grey.

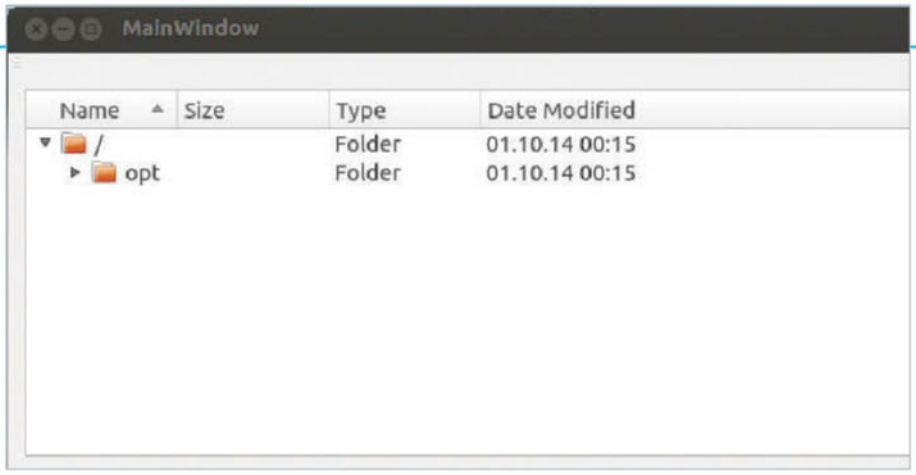
With that, our file list is now limited to displaying files which pose as pictures. Run the application once again in order to confirm that non-image files are no longer showing up in the treeview.

Accessing model data

Applications based on the Model-View-Controller pattern are not limited to displaying data found in the model. Well-implemented model classes provide a variety of ways which permit their users to interact with the data stored within – our QFileSystemClass is no exception to this rule.

Let us expand our file viewer by adding a feature which provides further information about a double-clicked item. This requires us to connect the treeview's doubleClicked signal with a newly-created slot in the main form.

Click the Signal/Slot editor in the toolbar in order to inform Qt Creator about your intent to create connections between signals and slots. Drag a line from the treeview and drop it on the form. Qt Creator will respond by opening



Above Filters can be used to restrict the amount of information shown

Fig 04

```
void MainWindow::itemDoubleClicked(QModelIndex _anIndex)
{
    QFileSystemModel* whatModel = (QFileSystemModel*) ui->treeView-
>model();
    QFileInfo myFile = whatModel->fileInfo(_anIndex);
    QMessageBox *aBox=new QMessageBox();
    aBox->setText(myFile.path());
    aBox->show();
}
```

Fig 05

```
#include <QSortFilterProxyModel>
class ImagineFilterModel:public QSortFilterProxyModel
{
        Q_OBJECT
public:
    ImagineFilterModel(QObject *parent);
};
```

Fig 06

```
#include "imaginefiltermodel.h"
ImagineFilterModel::ImagineFilterModel(QObject *parent):
    QSortFilterProxyModel(parent)
{
    QFileSystemModel* myModel=new QFileSystemModel(this);
    myModel->setRootPath("/");
    setSourceModel(myModel);
}
```

Fig 07

```
MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);
    ImagineFilterModel* myModel=new ImagineFilterModel(this);
    ui->treeView->setModel(myModel);
}
```

the Connection dialog where the connection can be established. We covered this process in detail a few issues ago but you can also find more information on opening the dialog with a quick internet search.

Even though Qt will create the connection between signal and slot for us automatically, we must implement the necessary method by hand. Open mainform.h and add the declaration in **Fig. 03.** to the class.

Item views emit signals which contain a QModelIndex. It is a convenient item providing further information about the element which is to be processed. We can use this value in order to find out more about the file at hand (**Fig. 04.**)

Our form's constructor does not store a pointer to the model in a global variable. We start out by invoking the model() method which returns a pointer to a QAbstractModel. FileSystemModel's structure is such that the model can not contain anything except for a QFileSystemModel, which is why we simply cast the returned value to the desired type.

In the next step, the instance is queried in order to find out more about the item in question. This information is then shown in a QMessageBox.

Model-a-gogo

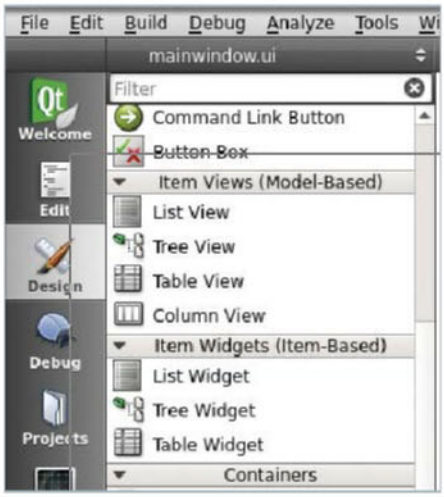
Using the QFileSystemModel has enabled us to create a file and folder viewer with minimal effort. We used only a few features of the class; it is possible to filter folders and perform a variety of other impressive stunts.

Developers seeking to get value out of Qt will be delighted to hear that the framework contains half a dozen different models which are dedicated to all kinds of useful tasks. For example, database access can be 'encapsulated' by using any or all of QSqlQueryModel, QSqlTableModel and QSqlRelationalTableModel.

String lists should be packed up into an instance of QStringListModel. It handles the adaptation and preparation for display without further interaction from your end.

QStandardItemModel should be used when your code is to handle a set of items which are derived from QStandardItem. It is a relatively complex class providing a set of properties intended to simplify the creation of custom items for lists, tables and trees.

When dealing with legacy code, you might stumble across a legacy class called QDirModel. It differs from QFileSystemModel as it handles the file system traversal on the GUI thread. This can have a significant negative performance



Above Data presentation widgets can come in two different groups

impact when large amounts of files and folders are to be traversed.

Model-to-model

Large and complex applications benefit from the ability to display the same data set in different forms. Duplicating the information wastes memory and forces developers to implement all kinds of synchronisation logic.

If the changes are limited to changes in the sorting and filtering of the individual items, a proxy model can be attached to the host model containing the actual data. It rearranges and filters the elements in order to create an independent second view of the information at hand.

Even though our QFileSystemModel provides the ability to sort and filter results, we will add a second layer for posterity and effect.

Start out by adding a new class to the project: Qt Creator's 'Add Class' wizard can be invoked via File>New File or Project. Select the C++ group in order to find the C++ Class template. The new class is called ImagineFilterModel in the example code – feel free to assign another name if you desire to do so. The header file looks like the one shown in **Fig. 05**.

QSortFilterProxyModel is a QObject-derived class. Qt's backend requires that the header of such classes is to be marked with the Q_OBJECT macro, as you can see in **Fig. 05**.

ImagineFilterModel's constructor is populated with the bit of code in **Fig. 06**.

Classes derived from QsortFilterProxyModel need a source model which acts as the actual data store. We simply assign the QFileSystemModel from above in order to prepare the adapter for insertion. Modify the form's constructor in mainwindow.cpp in order to inform it about ImagineFilterModel (**Fig. 07**).

> "Treeviews do not permit users to sort their content by default"

Fig 08

```
class ImagineFilterModel:public QSortFilterProxyModel
{
        Q_OBJECT
public:
    ImagineFilterModel(QObject *parent = 0);
protected:
    bool lessThan(const QModelIndex &left, const QModelIndex &right);
};
```

Fig 09

```
bool ImagineFilterModel::lessThan(const QModelIndex &left, const
QModelIndex &right)
{
    QFileSystemModel* myModel=(QFileSystemModel*)sourceModel();
    QString leftName=myModel->fileName(left);
    QString rightName=myModel->fileName(right);
    if(leftName.compare(rightName)<=0)return true;
    return false;
}
```

Fig 10

```
MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);
    ImagineFilterModel* myModel=new ImagineFilterModel((QObject*)this);
    ui->treeView->setModel(myModel);
    ui->treeView->setSortingEnabled(true);
}
```

Running the program in its current state yields an unfiltered treeview showing the contents of your file system. Let us proceed to changing the sort order so that files and folders will be shown in a strictly alphabetic fashion (eg without the precedence which is normally given to folder objects).

QSortFilterProxyModel comes with sorting logic. Sadly, the class cannot channel how you wish the items to be arranged. This information is to be passed in via a virtual method which can be overridden in the header (**Fig. 08**).

For our example, check out **Fig. 09,** where the implementation found will suffice in order to get the desired results.

Treeviews do not permit users to sort their content by default. This can be solved by setting sortingEnabled to true (**Fig. 10**).

Run the example in its current form in order to see a finely-intertwined list of files and folders.

Conclusion

With that, our journey through the fascinating world of Qt ends for another issue. Even though getting familiar with models might take a bit of time, the skills gained in the process involved will pay out tenfold in the long run simply because a well-structured application is so much easier to debug and maintain. Eventually, it will save you both time and effort.

The next part of our Qt tutorial will take modelling one step further. We will be learning how to create custom models based on data stores already in your application. This second part will enable you to keep your concerns separated as the level of complexity increases.

Creating lists and working with treeviews has never been so easy – see you soon!

Win a FUZE
Enter now at bit.ly/1nSQZrK

Learn to code BASIC with FUZE

Discover the language that started it all with FUZE, the Pi-powered programming and electronics platform

Advisor

Rob Zwetsloot models complex systems and is a web developer proficient in Python, Django and PHP. He loves to experiment with computing

Resources

FUZE BASIC kit fuze.co.uk

A lot of the great British coders from Generation X are usually considered to have got their start thanks to the BBC Micro and the BBC Computer Literacy Project in the Eighties.

At the time, the cheap hardware was affordable for schools and allowed kids to code in 'Beginner's All-purpose Symbolic Instruction Code', or BASIC. This simple language opened up programming to kids of all ages in schools and created a British computing boom. Times have slightly changed and after a bit of a struggle, computing is back into British schools. While they won't be learning BASIC anymore, the language still exists and is an excellent way to teach programming. The FUZE line of hardware aims to bring that back with special Raspberry Pi-powered machines.

Not only can you code in the BASIC language but you can also work on creating physical projects using an excellent custom IO board attached to the FUZE device.

In this tutorial we'll show you how to use BASIC for programming and how to create a traffic light system.

Learn to code BASIC with FUZE

Discover the language that started it all

TUTORIAL

01 Hook up FUZE BASIC

01 Hook up FUZE BASIC

Some of the FUZE models already have a Raspberry Pi built into it, so all you need to do is hook it up to a monitor and power source to get it going. Make sure the SD card is placed into the slot before you plug it in using the supplied power adaptor.

02 BASIC interpreter

The FUZE will boot into a desktop of a modified Raspbian. Here you can do your normal Raspberry Pi-related activities, but what we're interested in is the FUZE BASIC option on the desktop that takes us to the BASIC interpreter.

03 Say hello

Our first foray into a programming language needs to be done right with a proper "Hello World" statement. It's very simple to do in BASIC and just requires you to write:

```
>PRINT "Hello World"
```

04 Look around you

While this version of BASIC has been updated since the BBC Micro days, you can still perform some of its more simple tasks and the infamous GOTO 10 command. You can do this by executing commands like this:

> **"FUZE will boot into a desktop of a modified Raspbian. Here you can do all your normal Pi activities"**

```
>10 PRINT "Hello World"
>20 GOTO 10
```

05 The modern way

Press Esc to end the loop. BASIC has seen some improvements in this version, so we can create this endless loop of Hello World by using a better loop statement in the code editor. To access the editor, press F2.

06 Modern loop code

The code for this is quite simple: we create a CYCLE, place the command within it and then tell the code to return to the beginning of the cycle with REPEAT at the end. In our case:

```
CYCLE
PRINT "Hello World"
REPEAT
```

07 Save and run the code

Once you've typed it in, you can press F3 to bring up the option to save the code. For now, just call it helloloop and press Return. Once that's done the code will run, looping Hello World over and over. Press Esc twice to end the loop.

08 Make variables

Creating a variable in BASIC is easy and is like most other languages:

```
A = 5
```

Use PRINT "A" to confirm it's worked. You can modify the value by adding a number or other predefined variables like so:

```
A = A + 5
```

```
A = A + B
```

09 Something more complicated.

Automatically increasing the value of a variable is easy. Let's create a fixed loop that prints out A as it increases from 1 to 5:

```
CLS
A = 0
FOR p = 1 to 5 CYCLE
        A = A + 1
        PRINT A
REPEAT
END
```

10 Wire up a project

The IO board offers a lot of extra functionality that's perfect for learning physical programming. While you can connect directly to the Pi's GPIO ports via the header, you can also use the custom ports. The tray at the top of the FUZE is perfect to slot the breadboard into, so do that now.

11 Wire up a light

Choose one of the LEDs from the pack of electronics – any colour is fine – and then insert the short end into one of the two pins along the top and insert the long end into the middle section. Grab a 100Ω resistor (brown black brown gold) and insert one end into one of the pins that are on the same vertical row as the long end of the LED.

12 Connect the light

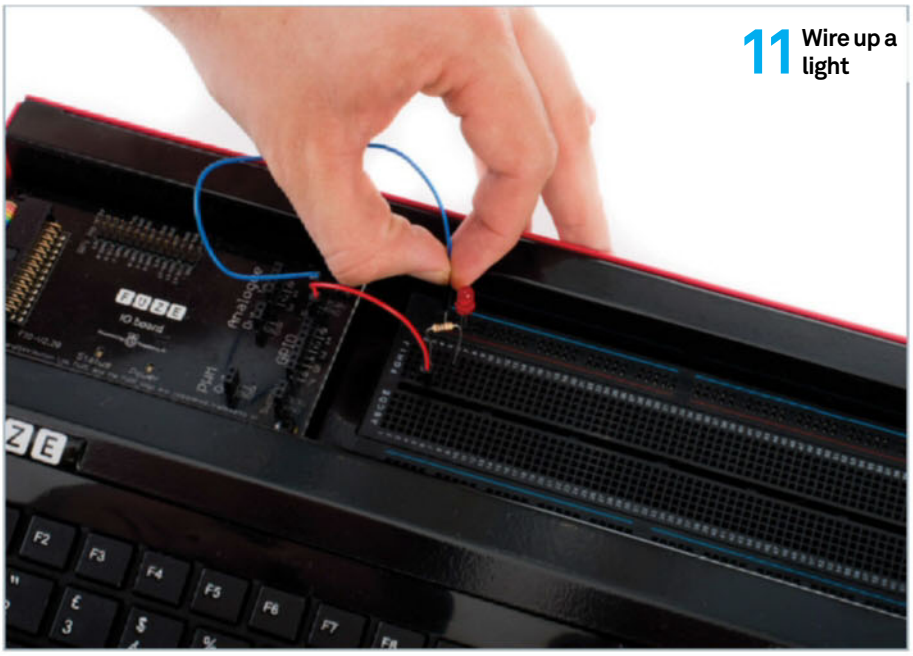
Place the other end of the resistor on a pin in a different vertical column and then use a jumper wire to connect GPIO 0 to this end of the resistor on the vertical. Finally, attach a wire to GND on supply and put it on the same row as the short end of the LED.

13 Easy operation

To activate the light, exit the editor using Esc and type the following line to let it know to set GPIO 0 as an output:

```
>PinMode (0,1)
```

> You can connect directly to the Pi's GPIO ports via the header



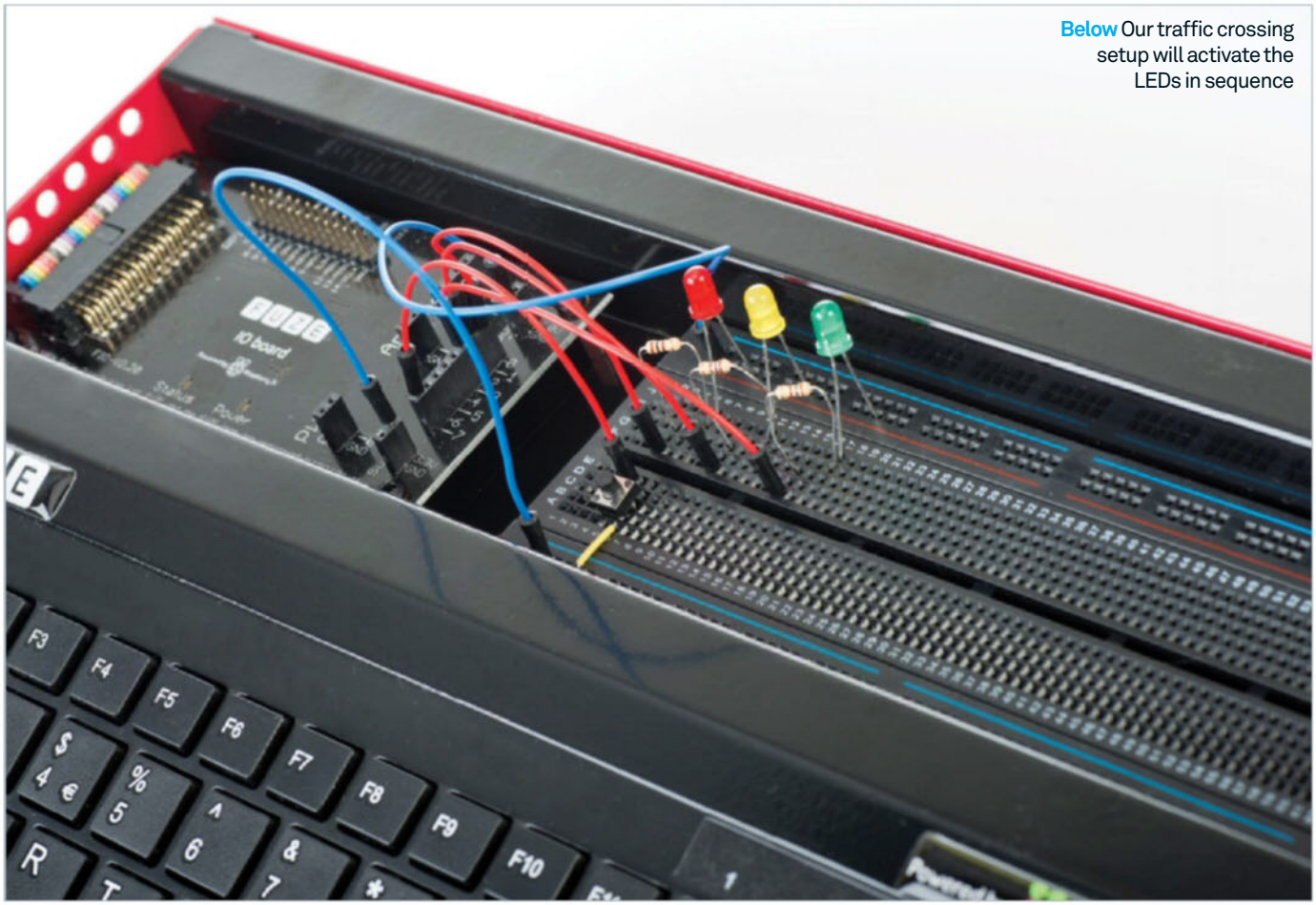
To activate it and then deactivate it, use:

```
>DigitalWrite (0,1)
>DigitalWrite (0,0)
```

14 Light coding

Now that we've got our light working, let's create a little code that will turn it on and off repeatedly:

```
CLS
PinMode (0,1)
CYCLE
DigitalWrite (0,1)
Wait (1)
DigitalWrite (0,0)
Wait (1)
REPEAT
END
```



Below Our traffic crossing setup will activate the LEDs in sequence

15 Bigger project

Let's ramp up the lighting setup on the breadboard and make it into a traffic crossing setup. Add two extra lights in the same way we added the original LED and attach them to GPIO pins 2 and 3. Wire up a button by attaching one end to pin 7 and the other end to a new 3.3V rail taken from the second set of power pins. The button will make the lights go 'red' in sequence, then after a pause go back to 'green' – see **Fig. 01** for the full code.

16 CLS

The CLS command clears the current display. This is helpful to make sure any errors or printouts from your code will show up without possibly blending in with outputs from previous programs or runs.

17 Use PinMode

The numbers on the PinMode variable handles the GPIO port (X) as well as whether it's an output (1) or input (0). It is therefore constructed like so for GPIO X as an output:

```
PinMode (X,1)
```

DigitalWrite is constructed similarly for output pins, with 1 being on and 0 being off.

18 IF THEN

Unlike other coding languages, when you create an IF statement you need to make sure THEN is appended to let BASIC know that the following code is for a True situation.

19 digitalRead

As pin 7 in this code is set as an input, we want to read when it's activated (ie when the button is pressed). Our button completes the circuit when pressed so the read needs to be 1.

20 ENDIF

Let the code know when the IF statement ends by adding ENDIF to the end of it. This can make it slightly easier and clearer for figuring out where an IF begins and ends compared to other languages.

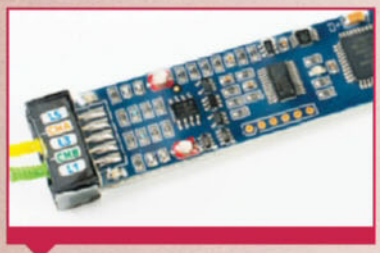
Fig 01

```
CLS
PinMode (0,1)
PinMode (1,1)
PinMode (2,1)
PinMode (7,0)
CYCLE
    DigitalWrite (2,1)
        IF digitalRead (7) = 1 THEN
            Wait (1)
            DigitalWrite (2,0)
            DigitalWrite (1,1)
            Wait (1)
            DigitalWrite (1,0)
            DigitalWrite (0,1)
            Wait (5)
            DigitalWrite (1,1)
            Wait (2)
            DigitalWrite (0,0)
            DigitalWrite (1,0)
            DigitalWrite (2,1)
        ENDIF
REPEAT
END
```

THE ESSENTIAL GUIDE FOR CODERS & MAKERS

PRACTICAL Raspberry Pi

Contents



BUILD A SUPER RASPBERRY PI

Pool the resources of multiple Pis to create your own scalable Pi supercomputer

The Raspberry Pi is actually quite powerful for its price. On its own, though, you won't be doing any extraordinary calculations – or compiling or anything strenuous at all, for that matter. However, as it's readily available and fairly cheap, you can get twenty of them for the price of a new computer. Each of them on their own will be no different, but link them together over a network and you can have them share their power and vastly increase the amount they can process.

This kind of setup is generally known as a Beowulf cluster, so named for the eponymous hero of the epic poem in which Beowulf is described as having "thirty men's heft of grasp in the gripe of his hand". It's not ridiculously hard to achieve, either – all you need is a lot of Raspberry Pis, a bit of Python know-how and a reason to use it. This makes it a good project for things like classrooms, after-school Pi clubs and the like – really, anywhere there's a collection of Pis available for general use. The more Raspberry Pi nodes you add into the setup, the more powerful it will become, which means you can start with just two or three at home and then gradually add more and more to your cluster, if you want to. And because of the way it all works, you can hook in and control your SuperPi cluster from your main computer as well, making this as accessible as it is scalable.

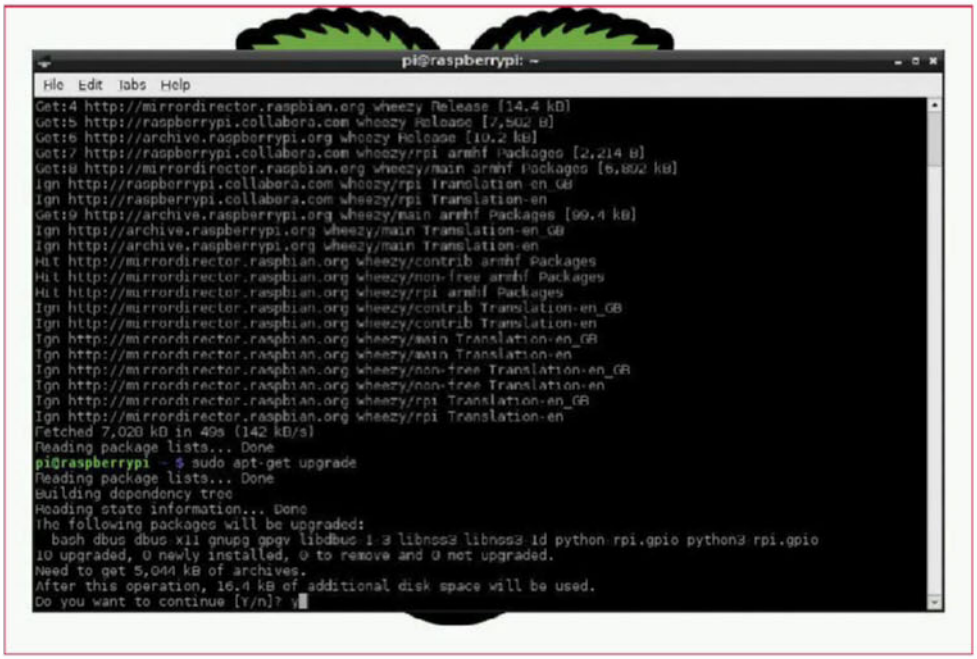
Over the next few pages we're going to show you how to get your Raspberry Pis set up ready for use, including all the tools you'll need, how to get them all connected and then finally what you can do with all that processing power. We'd love to see your SuperPi once it's finished – drop us a tweet!

Works with every Raspberry Pi!

You can even create a cluster of different types of Pi

Programming your Pis

Get your Pis set up to talk to one other and share their processing power



Left If you want the SuperPi to become a reality then updating everything is crucial

What you'll need

- As many Raspberry Pi computers as you want
- SD card with up-to-date version of Raspbian
- mpi4py MPI python module pypi.python.org/pypi/mpi4py
- Updated firmware on Raspberry Pi

01 Fully updated Pi

It's very important that your Raspberry Pi computers are fully updated for this, so make sure everything is compatible, including the firmware. This can be done with three commands in succession, and make sure you do it on every Pi in turn:

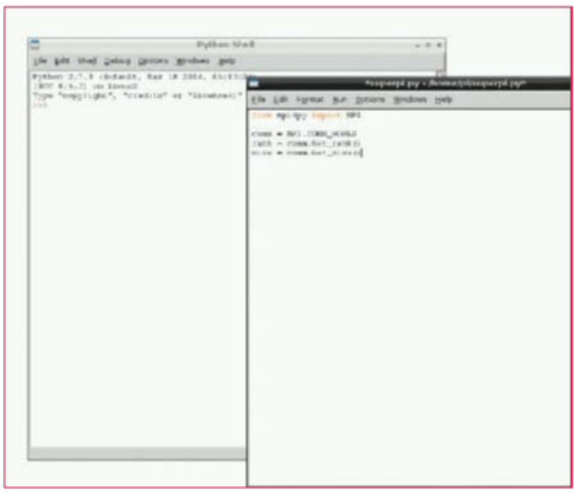
```
$ sudo apt-get update
$ sudo apt-get upgrade
$ sudo rpi-update
```

02 Get the MPI module

Install the mpi4py Python module in the terminal by using the following command (again, on every Pi):

```
$ sudo apt-get install python-mpi4py
```

The module will also work on Arch or other Raspberry Pi distros, although you'll need to add it manually or install it via pip.



03 Create your threads

To use MPI in Python, first import it with:

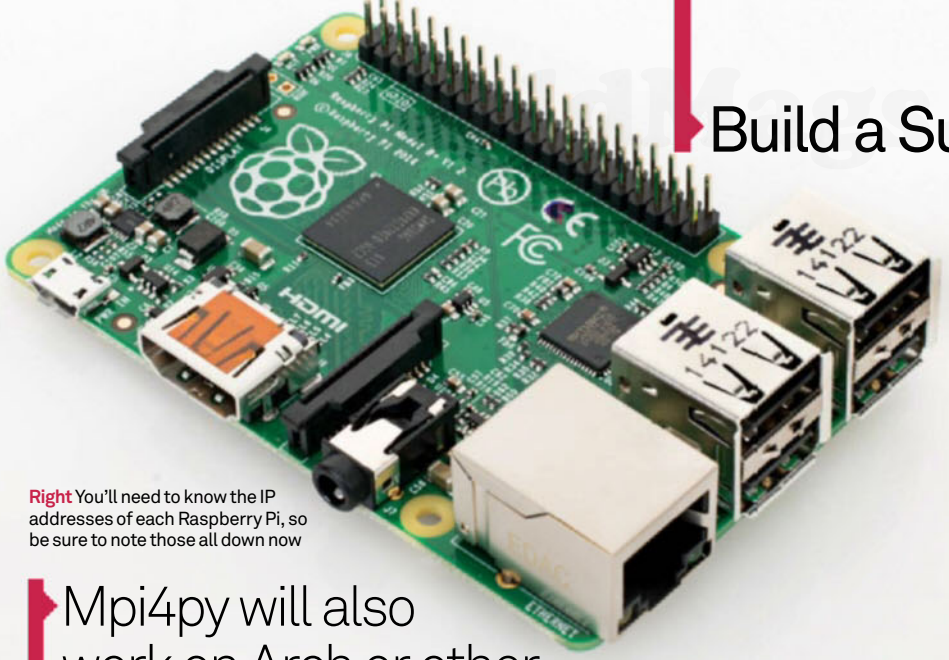
```
from mpi4py import MPI
```

The most important part of the code is telling MPI how to rank the threads and recognise their size. Do this with:

```
comm = MPI.COMM_WORLD
rank = comm.Get_rank()
size = comm.Get_size()
```

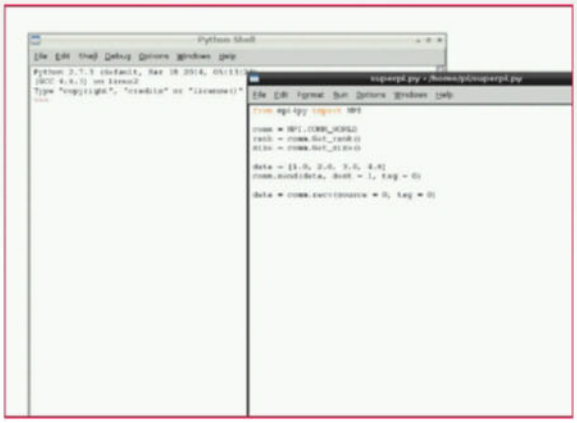
Other libraries

The mpi4py library can also be used with Numpy, the numerical and mathematics module for Python. This can be installed using sudo apt-get install python-numpy, and is very useful for doing the kind of large calculations that a cluster would be making. We'll be using it in our example over on the next page, so install it now.



Right You'll need to know the IP addresses of each Raspberry Pi, so be sure to note those all down now

Mpi4py will also work on Arch or other Raspberry Pi distros



04 Send and receive data

Sending data is quite easy: you need to give it a destination thread so MPI knows what it is when it returns, halting the original thread until it does:

```
data = [1.0, 2.0, 3.0, 4.0]
comm.send(data, dest=1, tag=0)

data = comm.recv(source=0, tag=0)
```

The tags allow you to parse what to do with some specific types of data.

05 Run the code

So that's the basics of how your code can be sent throughout a cluster. To actually activate the code and choose the Raspberry Pi recipients, you will need to write this in a terminal:

```
$ mpirun -host 192.168.1.20,192.168.1.21,192.168.1.22
python superpi.py
```

... with the IP addresses being the ones that are on the other Raspberry Pis.

06 Will it work?

What we've done above won't really do anything, but it at least illustrates how you can send code around the network. You can do it for any type of calculating but, due to some of the network lag, it's only worth it for large numbers and bigger data.

Full code listing

```
from __future__ import division

import numpy as np
from mpi4py import MPI

# Grab parutils from FileSilo or our website and put it in the
same folder as this. Use it to then print the number of cores used

from parutils import pprint

comm = MPI.COMM_WORLD

pprint("-"*78)
pprint(" Running on %d cores" % comm.size)
pprint("-"*78)

# Set up a ranking structure for the different nodes
my_N = 4
N = my_N * comm.size

if comm.rank == 0:
    A = np.arange(N, dtype=np.float64)
else:
    A = np.empty(N, dtype=np.float64)

my_A = np.empty(my_N, dtype=np.float64)

# Scatter data into my_A arrays
comm.Scatter( [A, MPI.DOUBLE], [my_A, MPI.DOUBLE] )

pprint("After Scatter:")
for r in xrange(comm.size):
    if comm.rank == r:
        print "[%d] %s" % (comm.rank, my_A)
    comm.Barrier()

# Everybody is multiplying by 2

my_A *= 2

# Allgather data into A again and print results
comm.Allgather( [my_A, MPI.DOUBLE], [A, MPI.DOUBLE] )

pprint("After Allgather:")
for r in xrange(comm.size):
    if comm.rank == r:
        print "[%d] %s" % (comm.rank, A)
    comm.Barrier()
```

Construct your SuperPi

Now you've programmed your Raspberry Pi units, it's time to link them together

Programming the Raspberry Pis is one part of constructing your supercomputer – properly housing them together is another problem. The very basic things you require to get them to work is power and a local network via a router and/or switches. This then extends to cases, SD cards and even Raspberry Pis themselves.

To make sure you get the most out of the system, you'll have to get the right selection of components to power and connect them.

> You won't need the maximum amount of power in a cluster, as you won't be powering a display or a camera off the GPIO ports

Power supply

A good power supply is extremely important when powering a Raspberry Pi, otherwise it will power on and run but you won't be able to get the most out of it. If you're using the Model B+ and notice a rainbow square in the corner, that's an indication you're not giving it enough power.

You won't need the maximum amount of power in your cluster, as you won't be powering a display or a camera or possibly anything off the GPIO ports, so the recommended two amps may be a little overpowered for your needs, even if you do push the processor to its limits. However, if you plan to do any overclocking then the two-amp power supply will become more and more necessary, and it's a lot better to be on the safe side.

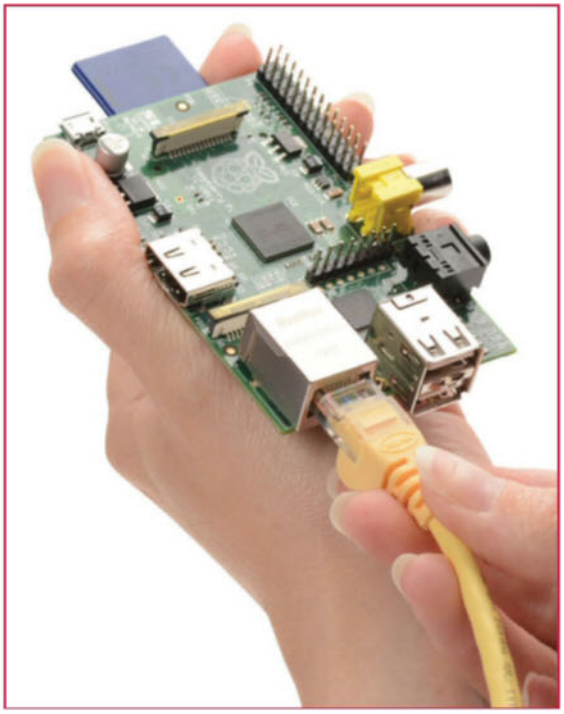
As your cluster grows you'll also need to make sure you have plenty of surge protection as the Raspberry Pis can be extremely sensitive.

We recommend:
Raspberry Pi Universal Power Supply
pimoroni.com

Networking

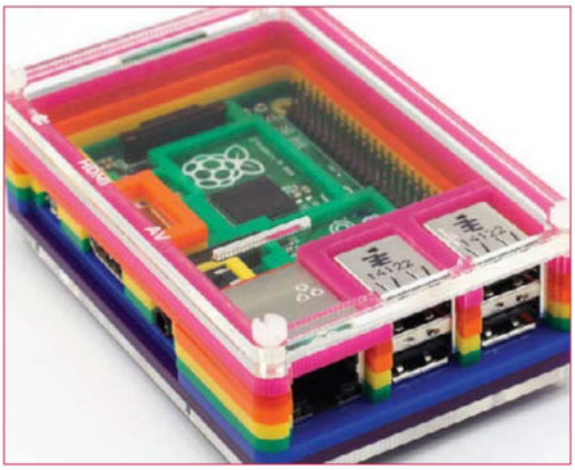
The more Raspberry Pis you plan to connect up, the more networking you will need to hook them together. The best method to do this is via cable, as it will carry any messages faster and with less latency than wireless – but creating the cluster isn't as easy as plugging it into a router, though. With more Pis you'll need more ports, and this can be accomplished by getting network switches. These are dumb connectors that contain no routing or address system, but allow you to connect more devices up to a central router.

Even though we recommend cabling, you can still use wireless to connect extra Pis. This also has the effect of cutting down on the amount of cabling and network switches you can use, but in general it's better to have a homogenous setup.



Overclock

If you find you still want a little extra power from your cluster, you could always try overclocking your Raspberry Pis. In Raspbian, you can do this from the config menu, accessible via sudo raspi-config. In the menu you will find an option to overclock with a few levels to select from. You can do this on separate Raspberry Pis or all of them, but be aware that doing so can shorten the lifespan of a Pi CPU, especially when set to the highest level.



Cases

There are many types of cases for a lot of Raspberry Pi uses: from simplistic plastic cases to protect the Pi from dust, to fully water- and weather-proof metal shells. One of the most versatile cases is the Pimoroni Pibow, which comes in a variety of sizes and configurations for all versions of the Raspberry Pi. The cases are all held together by screws that can easily be repurposed to help mount the Pis in a tower or other configuration so that they don't take up as much horizontal space.

They can be a little slower to get your Raspberry Pi into than some cases, but they're quite durable and easily customisable if you want to move them, or add a small touchscreen or scrolling LCD screen to the main Raspberry Pi to keep an eye on things without needing to SSH in.

We recommend:
Pimoroni PiBow
pimoroni.com

SD cards

SD card selection is a minor but still important factor when creating your cluster. Some Raspberry Pis come with an SD card which should be suitable enough, but others you'll need to buy some cards for. We recommend getting 4GB cards; while a 2GB card will do the job, 4GB allows you to use NOOBS if you have to and is also future-proof for larger distros and operating systems. As the Model B+ requires a micro SD card, make sure you have the right ratio of SD and micro SD cards.

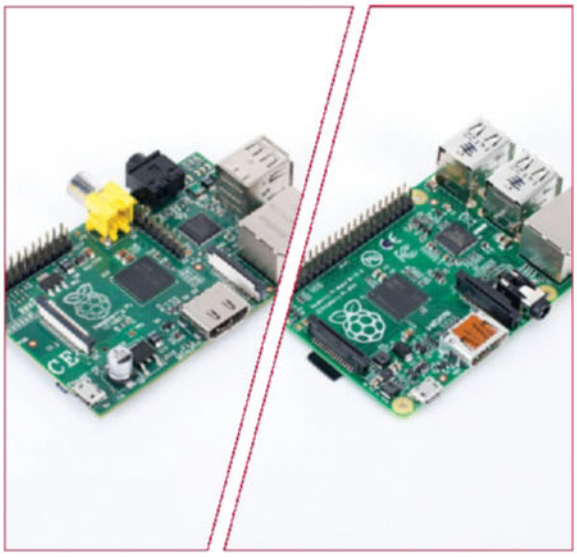
When it comes to getting the SD cards all set up and homogenous, the easiest and quickest method is to first do all the installing and updating on one Raspberry Pi, minus the firmware update with rpi-update. Then create a copy of the disk by putting it into a Linux system, open up the terminal and use:

```
sudo dd bs=1M if=/dev/[SD card location] of=superpi.img
```

Once it's copied, you can write this to all the other cards using:

```
sudo dd bs=1M if=superpi.img of=/dev/[SD card location]
```

We recommend:
4GB
pimoroni.com



Raspberry Pis

It actually doesn't really matter what type of Raspberry Pi you use in your cluster – you could use a homogenous selection of the latest Model B+ or even have a mixture of the B+, B and Model As connected to each other. As long as you have them running the same software and possessing the relevant scripts, the system will work. The main differences you might encounter are the differing power draws between devices and that the Model As might be slightly slower for some calculations.

The Model A types do have a disadvantage in that they do not have an ethernet port built-in. However, they can still make use of a wireless dongle to connect to the overall network of Raspberry Pis.

Make sure you set a static IP address for each Raspberry Pi with a specific range covering their location on the network. This is helpful for two main reasons, the first one being the ability to always be able to call the correct address when running MPI, and the second being that you can then SSH in and maintain your Pis from afar.

We recommend:
Model B+
element14.com

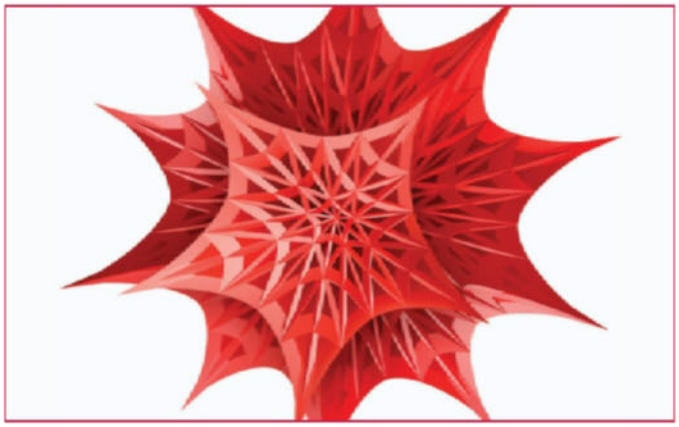
How to use your Super Raspberry Pi

Your supercomputer is ready to crunch some code. What will you have it do?

Donate power with BOINC

BOINC is the computer network system that allows you to donate idle CPU power to crunch big data, such as folding proteins or analysing signals from the cosmos to look for alien life. There's a specific app add-on for BOINC that lets you spread the workload across the MPI network and treat them all as extra CPU threads rather than extra units. The app details can be found here: bit.ly/1BBTS0W.

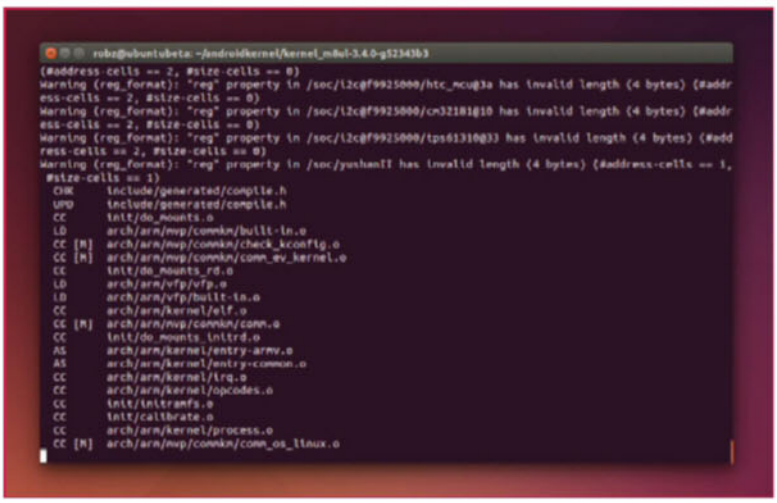
The Ras Pi on its own won't be able to add much to the pool, but linking several together can really boost the performance and create a powerful little node to help out with some projects. There are several you can donate processing power to involving science, medicine and maths. You can tweak BOINC to use more than just idling Pi power.



Modelling and simulations

Python and other languages can be used to create models of complex systems. Such models can include planetary orbits and objects interacting with them, huge mathematical equations and any resulting graphs for tides, the weather and much more. Many of these use a lot of calculations and can be slow even on a normal PC. Give them a lot more cores and you can get much faster, and sometimes more accurate, results.

Mathematica also contains some level of cluster support that works via Open MPI, the software we're using to link the Raspberry Pi network together. Wolfram has information on how it works and how to use it on their website (bit.ly/1oEYVb8), and it can really help with crunching the amount of data you can access and use in Mathematica.



Quick compiling

Now you have a lot more processing power at your disposal, you can try compiling Raspberry Pi programs on the cluster rather than just on the single Raspberry Pi. These will only really work on another Raspberry Pi, though, and compiling on a single Raspberry Pi can be extremely time-consuming compared to compiling on a proper PC or laptop.

There is, however, also a selection of MPI-only applications that can be built using your cluster to increase the functionality of cluster without relying on Python code. These must include specific MPI commands in the source code to make sure they run properly, which can be done a little differently than in our Python example. Look up the best practices for your programming language and if there are any extra modules or plugins you'll need for it. You can test the code in a similar way to how we tested the Python code.

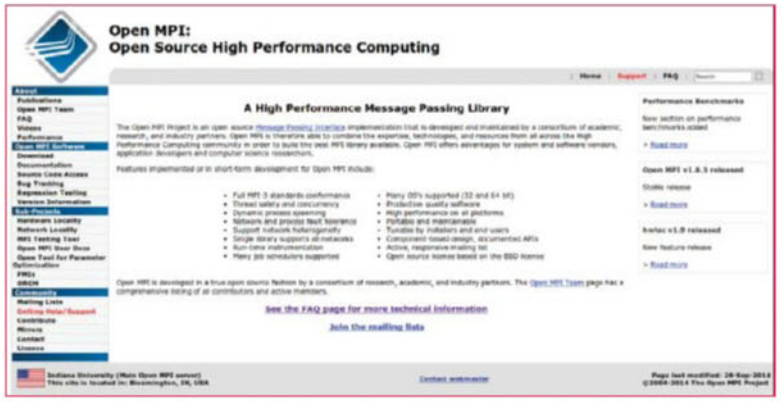
Resources

Find out more about MPI, Python and other ways to make use of your Super Pi

Open MPI

open-mpi.org

Open MPI (right) is the implementation of MPI that our Python module uses to send and receive data over the Raspberry Pi network. It supports all three major versions of MPI and, importantly, provides it in an open source format for everyone to use. There's full documentation for the extended library on the forums (**www.mpi-forum.org**) if you need to extend it past Python programs and take a little more control of what you're calculating and how.

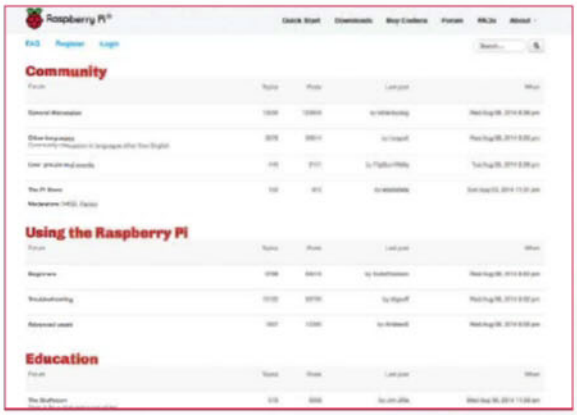


mpi4py documentation

pythonhosted.org//mpi4py/usrman/index.html

The Python module we're using has many more functions than the one we're using, and they're all contained in the documentation available on their website. You can learn how to do much more than just multiply numbers, as we showed you in our example, including the use of wrappers for other code, matrices of data and a couple other functions. It's very flexible and still in development so it's worth checking in on it and the change logs every now and then for new or different functions.

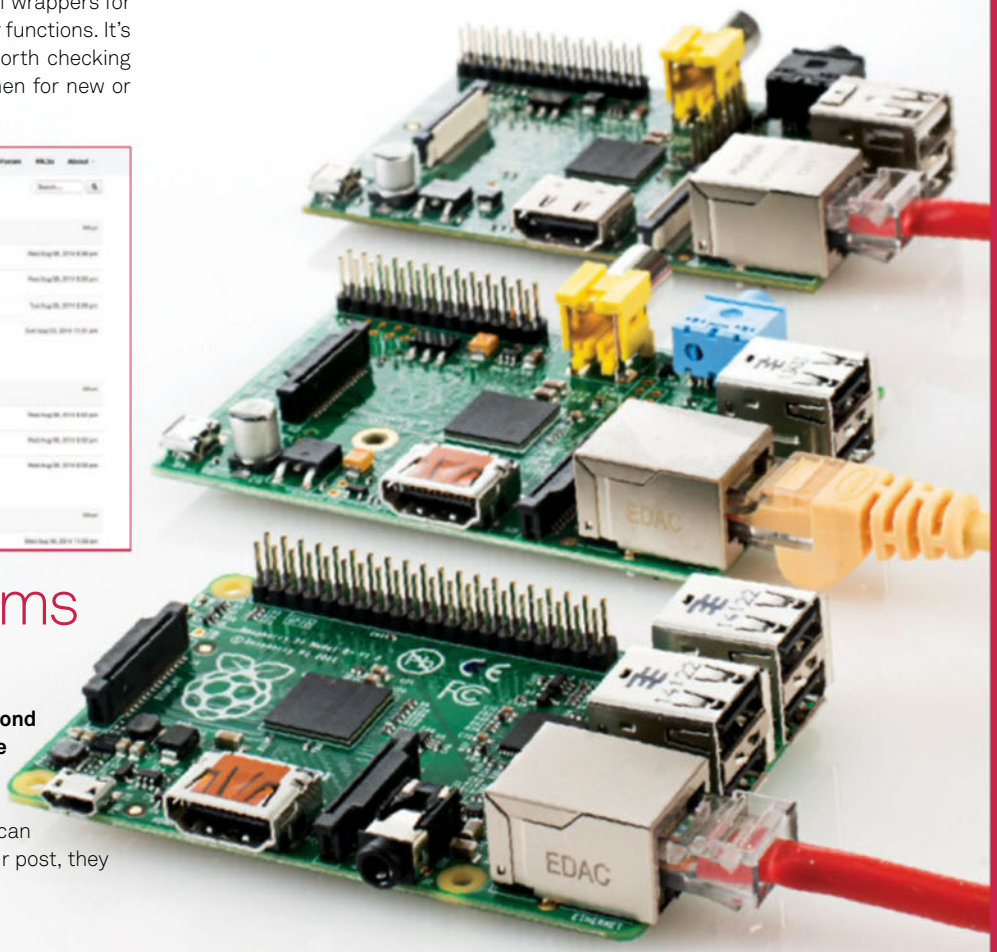
> You can learn how to do much more than just multiply numbers



Raspberry Pi forums

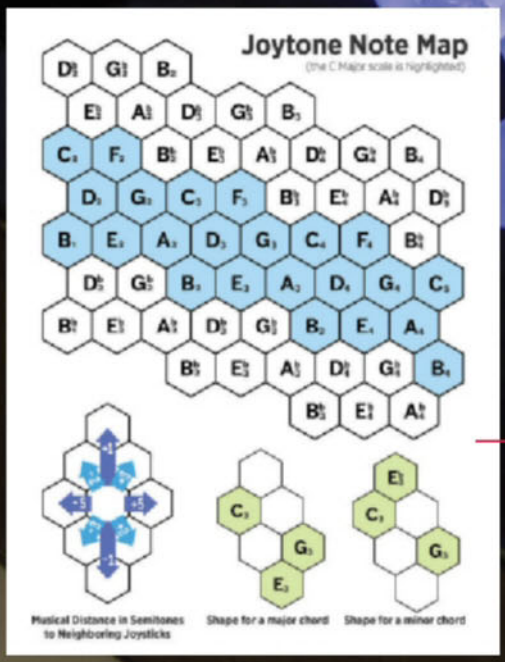
raspberrypi.org/forums

For anything going wrong with your Pi beyond MPI, your first port of call should always be the Raspberry Pi forums. The users are well experienced in using the Raspberry Pi and Linux, and will usually be able to help out. If you can give precise details and log files along with your post, they might be able to help you quicker.



Chords You can play chords by manipulating three thumbsticks at once – how you move them affects the sound of the notes in the chord

Thumbsticks Push forward/backward to switch between triangles and reverse sawtooth waves or push left/right to affect the oscillators

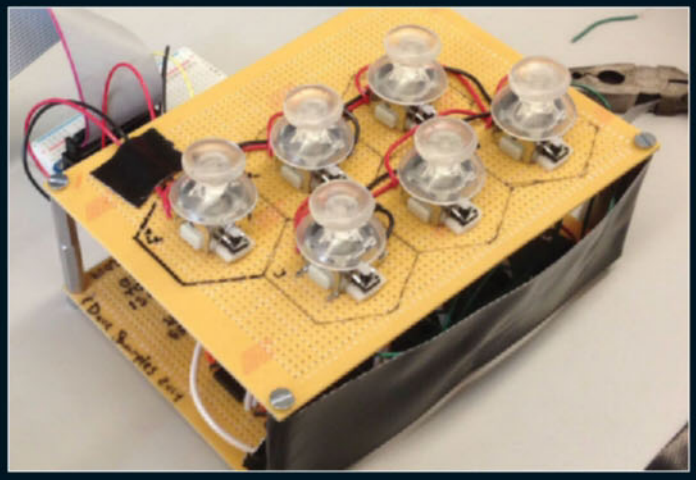


Isomorphic All the chords and scales you can play have the same geometric shape, no matter what key you're playing them in

Hexagonal grid The Joytone uses a hexagonal layout for the notes like electronic musical instruments such as Rainboard or apps like Musix

Above (inset) Getting to know the musical distances between adjacent thumbsticks is the key to learning to play the Joytone

Right There's a marathon lab session behind this six-note demo unit that Sharples and Glanzman presented at the CIS Senior Design Fair



Components list

- Raspberry Pi Model B
- Cypress PSoC 4
- Arduino Micro
- 57 Xbox 360 thumbsticks
- 57 NeoPixel Diffused 8mm Through-Hole LEDs (Adafruit)
- 8 16-channel analogue multiplexers
- 5 16mm Illuminated Pushbuttons (Adafruit)
- 200mm SoftPot Membrane Potentiometer

Joytone

David Sharples and David Glanzman reinvent the keyboard... by replacing the keys with a hex grid of joysticks

What inspired the Joytone?

David Sharples So the Joytone is an expressive isomorphic musical instrument. The project came out of my frustration trying to learn to play musical instruments. I was trying to teach myself piano and I was wondering why there are white keys and black keys, you know, it makes things so much harder. I learned a little bit of musical theory and came to realise that a major scale is just a well-defined musical structure; the gaps between the notes in a major scale are the same regardless of which major scale it actually is. But, because there's white keys and black keys on a piano, you can play a C major scale just by running up all the white notes. If you want to play a C# major scale you have to throw in a whole bunch of black keys. It's hard to remember and you have to build up this huge muscle memory. So one of the big goals with this project is to build a musical instrument that doesn't have that bias based on the keys – so it's isomorphic; that's what that means.

And you're using analogue thumbsticks?

David Glanzman They're Xbox joysticks...

Sharples That's the second big goal of the project. When I was doing research about this, I noticed there were some instruments that had these hexagonally isomorphic keyboards – a grid of hexagons – but the issue was that they were just buttons, they didn't have the same sort of richness and depth as an actual musical instrument. When you're playing a guitar there are a million ways to affect the sound – how hard you're pushing on the string, how hard you pluck it, where on the fret you're holding it, if you bend the string or not – and you can get all these rich sonic qualities. So we wanted to make it isomorphic and we wanted to make it expressive. We used these thumbsticks because you get two channels of analogue control in this really familiar little interface. One axis changes the waveform of the synthesised sound from a triangle wave (has a pure, bell-like quality) to a reverse sawtooth wave (has a buzzy, bright sound, like a trumpet). There are two oscillators creating each note and if you push the thumbstick to the left, those oscillators are exactly in tune, making a very soft sound. If you push it all the way to the right then they're offset by a couple of hertz, which makes a wide, rich sound. Then the amount that you rotate the joystick, regardless of direction, gives the volume. So you have like two and half dimensions of control there, which adds some depth to the sound.

What is the role of the Raspberry Pi?

Sharples There's kind of a two-brain system going on – we have the Raspberry Pi and then we have the Cypress PSoC 4. The Cypress PSoC 4 does all the heavy lifting with the data reading.

Glanzman It does all the measurements for the joysticks. It's got ADCs in it that convert analogue to digital, and then basically looks at each axis for each joystick in sequence, records it, and then waits for the Raspberry Pi to ask it for data values for each of the joysticks.

Sharples There's 57 thumbsticks and each one has two analogue channels, so that's 114 analogue channels total. So what we did was we had eight 16-channel multiplexers hooked up to the PSoC and then the PSoC sends a signal to all of them that says 'give me channel one'. Then it reads the eight channels, and then it says 'give me channel two' and it reads the eight channel twos. After it does that for all 16 channels it then has this full bank of current data. The Raspberry Pi periodically says 'give me all your most recent data', so the PSoC forwards the data to the Raspberry Pi, which then does a little bit of processing in Python and then sends commands to PureData, which is our synthesiser program.

What's the Arduino component doing?

Sharples Each thumbstick also has an RGB LED in its little hexagonal cell, and our intention was to use these to show which nodes are in key or out of key. We also wanted to guide the user through a scale – or even a song, showing the next note that they're supposed to play – but we ran into some technical difficulties. The ideal setup for this is that you daisy-chain all of these lights in a big line and then you hook them up to an Arduino Micro, which is actually really good at controlling these specific lights from Adafruit, and then it can just push all of this data down the line and you should just be able to put whatever colours you want on each light individually. But we had some problems with the signal and could only get about four lights to behave.

Is it easy to learn to play the Joytone?

Sharples The barrier to entry is much lower. It's funny, when we first got it working, David was playing with it, wearing headphones, and he sort of stopped talking and was pushing a few of the joysticks, like 'Wait, wait...', and then he just played back Bach. So the key to learning it is just learning a little, tiny bit about the structures in music theory. There's a shape you can hold your fingers in that will play a major chord; once you learn that shape, that's it – that's how all of the Joytone's major chords are played.

Glanzman When it comes to learning the Joytone, you have to attack musical instruction differently than you would with another instrument. When you learn something like the piano, you learn that this is D major, this is F# minor – you learn different things based on the note, the actual class, right? But with the Joytone, the pitch class is totally irrelevant because we hear everything in relevant terms, and you play everything in relative terms. So to learn the instrument, you don't even have to discuss pitch classes – you just talk about relative distances. So major thirds or minor thirds, fifths, fourths – it's distances between notes instead of the actual note values. I think if you phrase musical instruction in those terms, in terms that we experience music in rather than the terms we normally go through to create music, it becomes a much more natural interface with the Joytone because it's built on that type of instruction, making it simple to learn.

David Sharples is an interaction designer and graduated from the University of Pennsylvania's Digital Media Design programme

David Glanzman is a sophomore in Computer Engineering at the University of Pennsylvania. David has worked on microprocessor design, audio electronics, medical devices and more

Like it?

Interested in learning more about isomorphic instruments? Check out David Sharples' senior design blog: **davesharpl.es/blog**

Further reading

Here's the final demo video of the Joytone, comprising David Glanzman's virtuoso Bach performance: **bit.ly/1vfXnlw**

Leo White develops software for embedded Linux devices in his day job and tinkers with Raspberry Pis and robots in his free time. More ramblings can be found at **bit.ly/1l8wBPk**

Upgrade your Pi-powered Bigtrak

Get your Bigtrak ready for action by arming it with the Bigtrak Rocket Launcher!

What you'll need

- Pi-powered Bigtrak
  See issue 141
- Bigtrak rocket launcher
  bit.ly/1nRBjFo
- NPN transistor
- 47Ω and 470Ω resistors

Upgrade your Pi-powered Bigtrak

When the Bigtrak was re-released back in 2010 it was accompanied with two accessories, the Can Caddy and the Rocket Launcher. The Can Caddy is a couple of pieces of plastic that mounts onto the back of the Bigtrak and allows it to carry around a drinks can. But it's not very exciting and the top-mounted Raspberry Pi gets in the way of fitting it.

The Rocket Launcher, however, is a much more interesting item, consisting of four foam-tipped rockets that you can program the Bigtrak to fire as it trundles around. Of course, as you have to pre-program the Bigtrak's route, it gives your target ample opportunity to get out of the way.

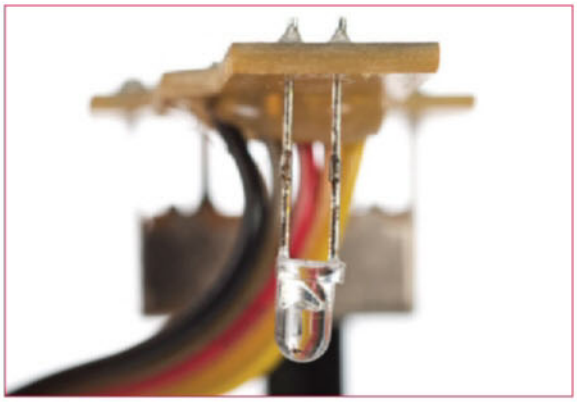
To rectify this flaw we're going to take the Raspberry Pi-controlled Bigtrak that we put together back in issue 141 and update it to fire rockets whenever you press 'X' on the controller.

01 Trigger the rockets

There are two ways of triggering the rocket to fire. The first, used by the Bigtrak Junior, is achieved by running a 4.5V current through the 3.5mm jack plug. The second, used by the Bigtrak, is to send an infrared signal to the Rocket Launcher in a similar way to how a TV remote works.

02 Power switch and IR LED

The Bigtrak's IR LED sits together with the power switch on a small PCB with a multicoloured ribbon cable running from it. Since we are only interested in the IR LED, we need to determine which cables connect to it. This can be done by following the traces running from the IR LED to the cables, or by using a multimeter.



03 Determine the polarity of the LED

Before we attach the IR LED to the chassis we need to determine which of the wires connect to the anode (positive) leg and which connects to the cathode (negative) leg of the LED. Looking closely at the IR LED, you can see that one side is flatter than the other: this is the side the cathode pin is on.

Full code listing

```
import pygame
import time
import RPi.GPIO as GPIO
import subprocess

PS3_AXIS_LEFT_H = 0
PS3_AXIS_LEFT_V = 1
PS3_AXIS_RIGHT_H = 2
PS3_AXIS_RIGHT_V = 3

PS3_CROSS = 14

pygame.init()

j = pygame.joystick.Joystick(0)
j.init()

print 'Initialized Joystick : %s' % j.get_name()

DRIVEA0 = 17
DRIVEA1 = 24
STANDBY = 18
DRIVEB0 = 21
DRIVEB1 = 22
A0 = False
A1 = False
B0 = False
B1 = False

GPIO.setmode(GPIO.BCM)
GPIO.setup(DRIVEA0, GPIO.OUT)
GPIO.setup(DRIVEA1, GPIO.OUT)
GPIO.setup(STANDBY, GPIO.OUT)
GPIO.setup(DRIVEB0, GPIO.OUT)
GPIO.setup(DRIVEB1, GPIO.OUT)

GPIO.output(DRIVEA0, A0)
GPIO.output(DRIVEA1, A1)
GPIO.output(STANDBY, False)
GPIO.output(DRIVEB0, B0)
GPIO.output(DRIVEB1, B1)

threshold = 0.60

LeftTrack = 0
RightTrack = 0

def setmotors():
    GPIO.output(DRIVEA0, A0)
    GPIO.output(DRIVEA1, A1)
    GPIO.output(STANDBY, True)
    GPIO.output(DRIVEB0, B0)
    GPIO.output(DRIVEB1, B1)


try:
  GPIO.output(STANDBY, True)

  while True:

    events = pygame.event.get()
    for event in events:
```

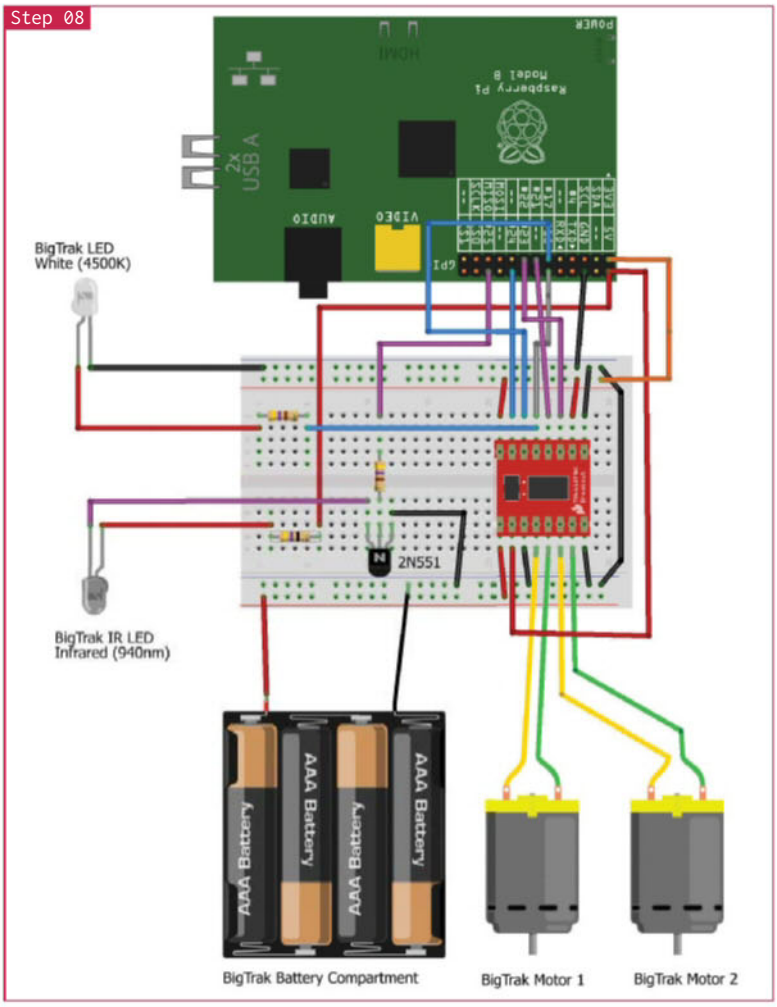
No power switch or IR LED?

When working on projects, we tend to keep any leftover components in a 'bits' box in case they become useful later on, such as for this project.

If you modified a Bigtrak during the previous tutorial and didn't keep the power switch, or if you just want to fire the rockets without the Bigtrak, then you can get a replacement IR LED that can be held in place with some electrical tape or sticky tack.

Driving a Bigtrak with Pi

Back in issue 141, we showed you how to connect up your Raspberry Pi to the Bigtrak in order to drive it using a PS3 controller. This tutorial follows on from that point, so you'll need to go back and give the other guide a read first. If you check out the version we uploaded to our website, you'll find a good Fritzing diagram to help with the wiring: **bit.ly/1plrGTw**



lircd.conf

```
begin remote

  name  Bigtrak
  flags RAW_CODES
  eps            30
  aeps          100

  ptrail       2026
  gap          60000

      begin raw_codes

          name fire
             3071     981    4053    2026    2026    4053
             4053    2005    2026    4053    2026   10154
             3050     981    4074    2005    2026    4053
             4053    2005    2026    4053    2026   10154
             3050     981    4053    2005    2026    4053
             4053    2026    2026    4053    2026   10133
             3050     981    4053    2005    2026    4053
             4053    2005    2026    4053    2026

      end raw_codes

end remote
```

04 Wire up the IR LED

Now that we know which two wires to use, they can be soldered onto a connector. We've used a module connector for ease of connecting to the breadboard, along with some heat shrink wire wrap to protect the soldered joints, which will reduce the chance of an accidental short circuit.

05 Re-attach the power switch

Turn the lid of the Bigtrak upside down and locate the mounting point for the power switch PCB. Carefully put the PCB into place and screw it down to hold it securely.

06 Transistors and resistors

The IR LED is going to be powered from the Raspberry Pi's 5V line, so to protect the GPIO pins from this higher voltage we'll be using a 2N5551 transistor to amplify the output from the GPIO pin, as well as several resistors to prevent too much current being drawn.

07 Wire up the components

Transistors have three legs called base, emitter and collector. We connect the emitter to the ground, the base (via a 470Ω resistor) to GPIO pin 25 and the collector connects to the cathode leg of the IR LED. To complete the circuit, the anode leg of the LED needs to be connected (via a 47Ω resistor) to the 5V pin on the Raspberry Pi.

08 Install the software

LIRC (Linux Infrared Remote Control) is a collection of utilities that allows the Raspberry Pi to send and decode IR signals. We'll be using the 'irsend' utility to launch the rockets. To install lirc, run:

```
sudo apt-get install lirc
```

09 Enable the LIRC

To enable LIRC and to tell it which GPIO pin to use as the transmitter run, use:

```
sudo nano /etc/modules
```

... and add the following lines, changing the value of gpio_out_pin to the one that the IR receiver is connected to and setting the gpio_in_pin to an unused pin. This version of the lirc_rpi module will require both in and out to be set.

```
lirc_dev
lirc_rpi gpio_in_pin=4 gpio_out_pin=25
```

10 Configure the LIRC

LIRC supports multiple ways of controlling IR, so it needs to be configured to use the Raspberry Pi GPIO pins. To do that, enter the following command:

```
sudo nano /etc/lirc/hardware.conf
```

... and either copy the code below from FileSilo.co.uk or manually change the DRIVER, DEVICE and MODULES lines to:

```
DRIVER="default"
DEVICE="/dev/lirc0"
MODULES="lirc_rpi"
```

11 Teach LIRC how to fire the rocket

To fire the rocket we need to send the correct set of pulses through the IR transmitter to trigger it. To learn these pulses, LIRC provides the 'irrecord' utility which, when combined with an IR receiver, allows us to record the IR pulses sent by an unmodified Bigtrak when it triggers its 'fire'

instruction. This will generate a configuration file that, after a few minor tweaks, looks like the one in the lircd.conf code listing at the bottom of the opposite page. You can manually enter these values by running...

```
sudo nano /etc/lirc/lircd.conf
```

... and exactly typing in the text, just like we used to do back in the early Nineties. Or you can just copy lircd.conf from FileSilo.

12 Test the LIRC setup

To enable the changes we need to reboot the Raspberry Pi by entering...

```
sudo reboot
```

... and, after rebooting, we can check that LIRC has correctly loaded by typing:

```
dmesg | grep lirc
```

13 Test fire the rockets

To check the hardware and software setup, we can fire the rockets manually by entering:

```
irsend SEND_ONCE bigbrak fire
```

If all has gone well then one rocket will launch! By running the command again you can fire off the rest of the rockets.

14 Add extra setup code to the Python script

To trigger the Rocket Launcher from the PS3 controller we need to make some simple changes to the Bigtrak.py Python script that we used back in issue 141.

To run the 'irsend' command from Python we will be using the 'subprocess' module, and we'll be using the 'X' button on the controller to trigger it. So towards the top of the Bigtrak.py file we need to add:

```
import subprocess
PS3_CROSS = 14
```

15 Response to the button press

We want the rocket to respond to our input and fire when the 'X' button is pressed, so after the existing code that checks if the analog sticks have been moved we just need to add the following lines:

```
elif event.type == pygame.JOYBUTTONDOWN:
  if event.button == PS3_CROSS:
    subprocess.call(["irsend","SEND_ONCE","Bigtrak","fire"])
```

Or again, just copy the updated BigtrakWithRockets.py script from FileSilo.

16 Run the script

With the code complete we can now run it with:

```
sudo python BigtrakWithRockets.py
```

If all has gone well, you can now drive the Bigtrak around and launch rockets on demand!

17 Next steps

With our rocket-toting Bigtrak, we're now a little closer to our plans for world domination (although we might be needing some bigger rockets for that). We've used one of the official accessories here, but there are plenty of unofficial accessories we could add. Ultrasonic sensors, a robot arm or the Raspberry Pi camera, perhaps?

Full code listing (Cont.)

```
      UpdateMotors = 0

      if event.type == pygame.JOYAXISMOTION:
      if event.axis == PS3_AXIS_LEFT_V:
        LeftTrack = event.value
        UpdateMotors = 1
      elif event.axis == PS3_AXIS_RIGHT_V:
        RightTrack = event.value
        UpdateMotors = 1

      if UpdateMotors:

        if (RightTrack > threshold):
          A0 = False
          A1 = True
        elif (RightTrack < -threshold):
          A0 = True
          A1 = False
        else:
          A0 = False
          A1 = False

        if (LeftTrack > threshold):
          B0 = False
          B1 = True
        elif (LeftTrack < -threshold):
          B0 = True
          B1 = False
        else:
          B0 = False
          B1 = False

        setmotors()
      elif event.type == pygame.JOYBUTTONDOWN:
      if event.button == PS3_CROSS:
        subprocess.call(["irsend","SEND_
ONCE","Bigtrak","fire"])

except KeyboardInterrupt:
  GPIO.output(STANDBY, False)
  GPIO.cleanup()
  j.quit()
```

Transistors & resistors

If you are using a different transistor then the value of the resistors may change.

One guide for calculating them can be found at **bit.ly/1qqtaqg** and the datasheets for these components can usually be found using a quick internet search.

Having trouble?

If the rocket doesn't fire then try checking the following:

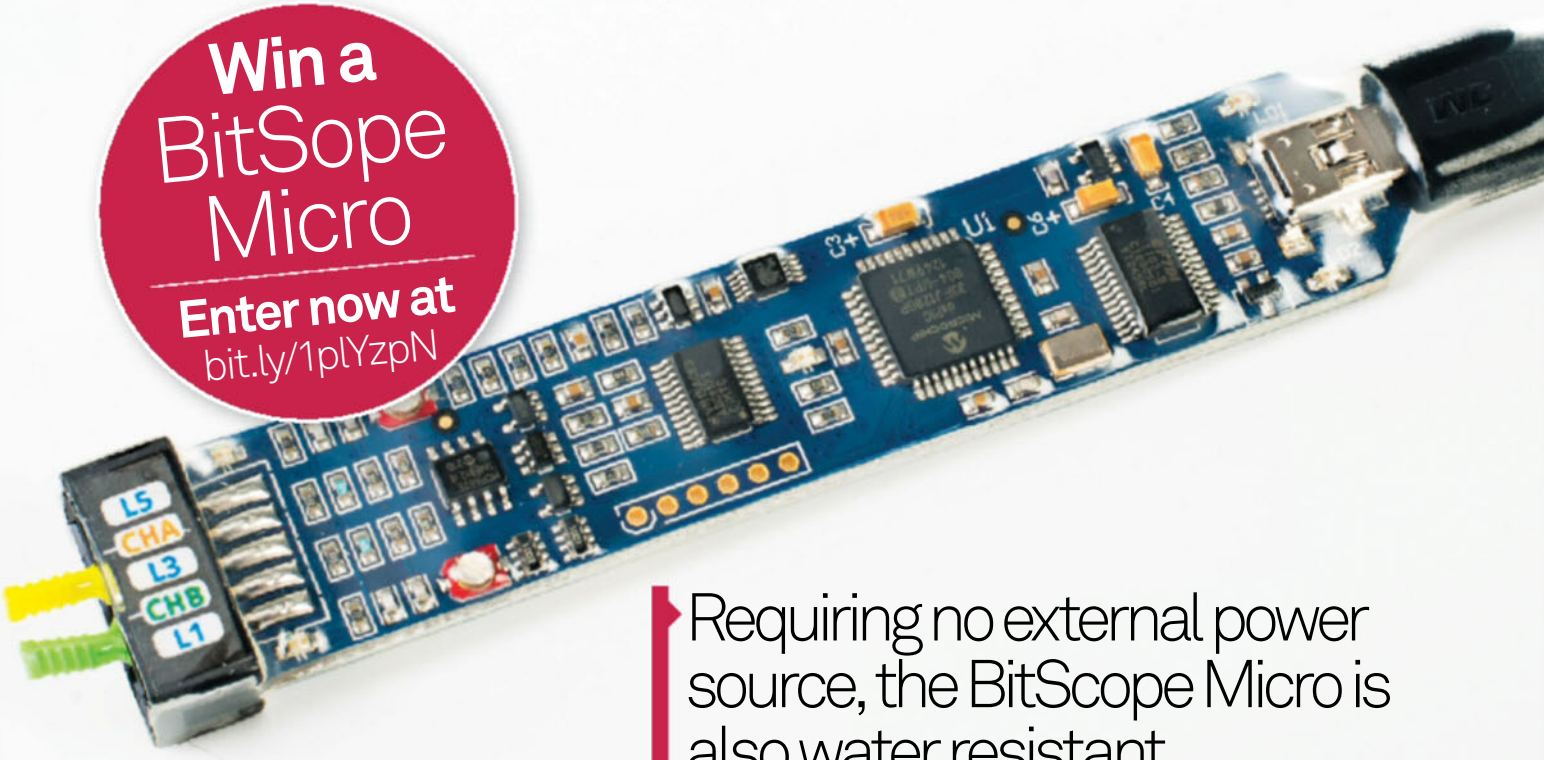
- Ensure all cables are connected correctly
- Make sure the rocket launcher hasn't turned off
- Swap the IR LED out for a normal LED. It should flash if the irsend command is working
- Double-check the IR LED isn't plugged in backwards.

Transform your Pi into a micro oscilloscope

Prepare to turn your Raspberry Pi into a fully functional micro oscilloscope, logic analyser and waveform generator with the BitScope Micro

Win a BitSope Micro

Enter now at bit.ly/1plYzpN



Requiring no external power source, the BitScope Micro is also water resistant

Aaron Shaw
Aaron volunteers at The MagPi (**www.themagpi.com**) and has been heavily involved with Raspberry Pi since the very beginning, finding himself fortunate enough to use Pis both at work and for play!

The Raspberry Pi has been used in a plethora of applications in hardware, software and some quite unbelievable combinations of the two. From record-breaking space flights to automated bartending devices and much more, there are thousands of Raspberry Pi projects that, over the last two and a half years, have shown what a capable little Linux box this is.

The BitScope Micro is certainly no exception and when you couple it with your Raspberry Pi you have a very powerful, pocket-sized oscilloscope that also features a whole host of other functionalities, such as a waveform and clock generator as well as a spectrum and logic analyser. Best of all though, the whole setup (including the Raspberry Pi itself) comes in at well under £150.

Requiring no external power source, the BitScope Micro is also water resistant and so is perfect for either home or lab use. It is fully configurable and user programmable in Python, C++ and more, and can even continuously stream data to disk.

01 Grab your BitScope

If you have not already done so, you need to go and order your shiny new BitScope Micro (directly from BitScope or from one of their worldwide retailers). If you are serious about electronics then you need a good oscilloscope, so it is truly worth every penny! Once it arrives, you should be greeted with the neatly packaged box pictured above.

Transform your Pi into a micro oscilloscope

Step 02

02 Open up the box

Once you have received your BitScope Micro and opened up the box for the first time you should find all of the pictured items inside (if you get any extras, then it is obviously your lucky day). The main contents are the BitScope Micro itself (with mini USB cable preattached) and a set of ten test clip grabbers. There is also a variety of documentation containing a large amount of product info and guidance.

03 Update your Raspberry Pi

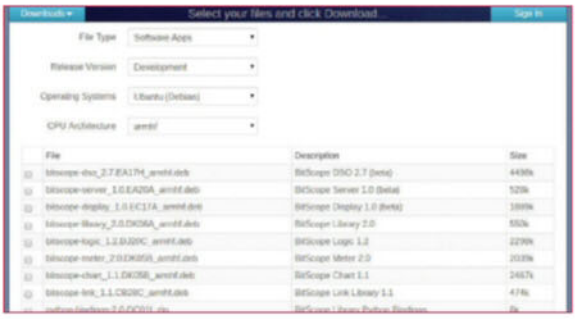
As with almost every project you undertake on the Raspberry Pi, it pays dividends to make sure your operating system is updated to the latest stable version, as this can save a lot of hassle further down the line. To do this, open an LXTerminal session and then type:

```
sudo apt-get update
sudo apt-get upgrade -y
```

Then wait patiently for the upgrade process to complete.

04 Locate the BitScope Software

Now your Raspberry Pi is all up to date you need to acquire the BitScope DSO (digital storage oscilloscope) software. This is not yet available as a Raspbian package, but it is very easy to install anyway using the downloadable DEB file. Visit **www.bitscope.com/pi** and click on the Download link at the top.



Above The BitScope Micro comes complete with test clip grabbers and a whole lot of documentation

05 Download the software

The previous step should have brought you to the BitScope Downloads page. From here you need to download the top item in the list, BitScope DSO 2.7 (beta), and save it to the /home/pi directory on your Raspberry Pi so you know where to find it later. On some browsers the file will automatically download to the /home/pi/Downloads directory.

06 Install the software

Now we have downloaded the package, the easiest way to install the software is to open an LXTerminal session and then run the following code...

```
sudo dpkg -i bitscope-dso_2.7.EA17H_armhf.deb
```

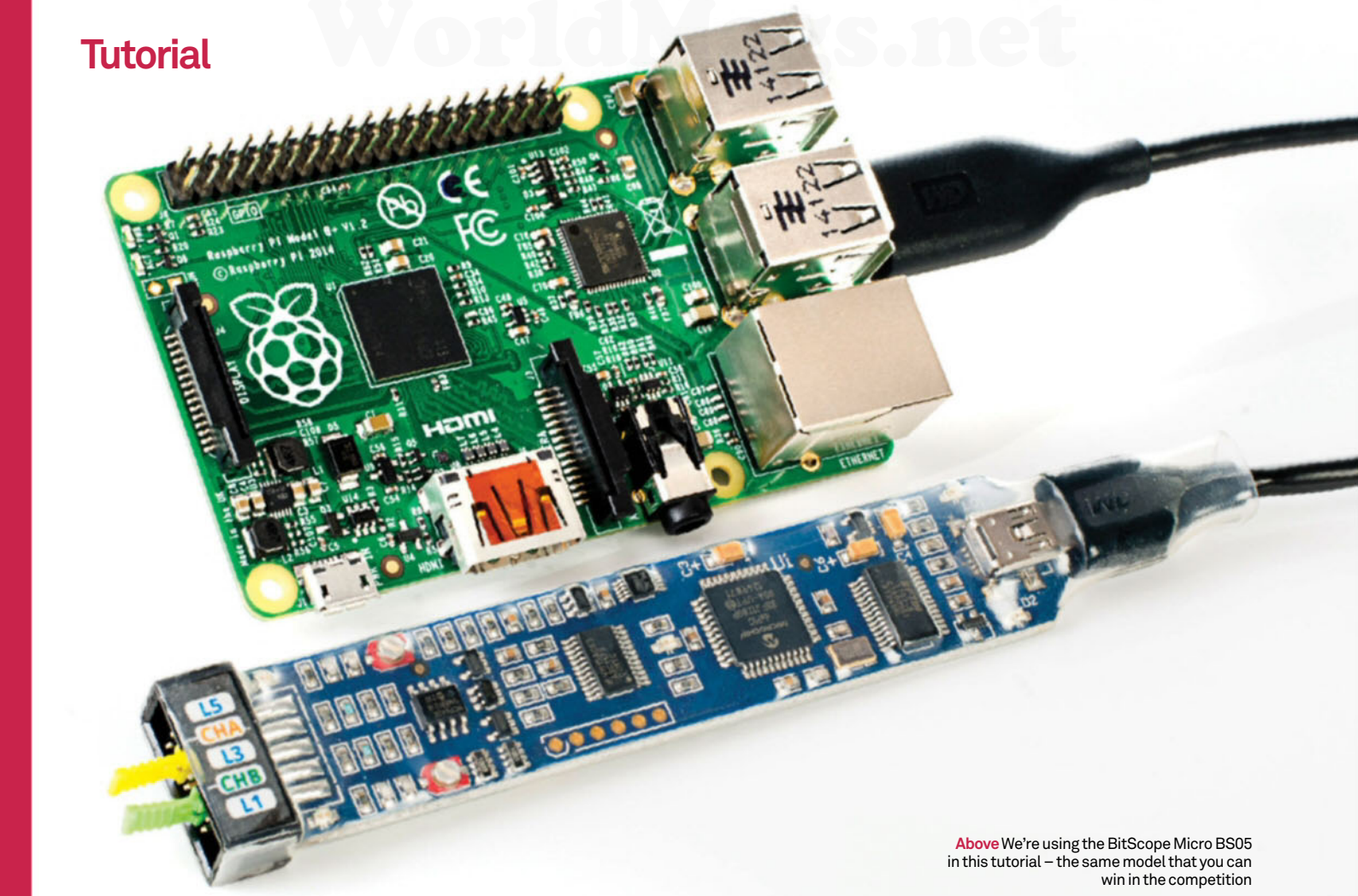
...or the equivalent version for newer software. You should see lines of output as the installation progresses. The BitScope DSO software then appears in the main menu under Other.

07 Overclock your Raspberry Pi (optional)

The BitScope software will run fine on a Raspberry Pi with default settings, however it can be a bit slow to respond. Open an LXTerminal session and type sudo raspi-config. In the menu, select option 7 Overclock. Click OK on the following screen and on the next one select Turbo. Click OK and then you should see some code run. Once this completes press OK and then you are brought back to the main raspi-config window. Select Finish at the bottom right, and then select Yes to reboot your Raspberry Pi.

Multiple platform support

One of the best things about the BitScope Micro (as well as its big brother, the BitScope BS10U) is that it's capable of running on a Pi and on any Linux, Windows or Mac OS X device with a USB port. The graphical UI is identical on each of these devices so it's easy to switch between them. The BitScope Micro should also work with smartphones capable of USB on-the-go connections, but there is no software available to take advantage of this yet.



Above We're using the BitScope Micro BS05 in this tutorial – the same model that you can win in the competition

Hardware upgrades

One of the best things about the BitScope Micro is that it runs on exactly the same software as the more capable hardware in the range. This means if at some point in the future you feel the BitScope Micro is not enough for your needs, you can quickly and easily upgrade to better hardware with no hassle, and no need to learn any new software!

08 Overclocking – part two

Overclocking can sometimes cause instability on your Raspberry Pi or an inability to boot at all. If this happens, you can press and hold the Shift key on your keyboard once you reach the above splash screen to boot into recovery mode. You can then re-do step 7 at a lower overclock setting and repeat until you find the highest stable setting.

09 Plug in the BitScope

Now that the software has been successfully installed on your Raspberry Pi, we can get started with the BitScope. If you are using a Model A or B Raspberry Pi without a USB hub then I would recommend turning the Raspberry Pi off before attaching the BitScope or it may crash. The B+ should be fine with plug and play.

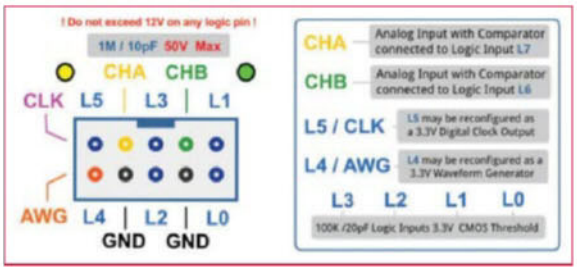
10 Load the BitScope DSO

Now you can navigate to the BitScope DSO software in the menu. This should load a splash screen with two options – POWER and SETUP. Click POWER and then OK on the pop-up information box. After a minute or less, the BitScope DSO main screen will load and you should see some lights on the BitScope start to flash.

Overclock can sometimes cause instability

11 Familiarise yourself with the software

The image on page 33 shows the screen layout of the BitScope DSO software. It is fairly intuitive, and is similar to other physical or virtual oscilloscopes. The largest part is the main display window. To the top-left is the trigger window (this changes to wave control if selected). Under the main window you have the analog input channels and various trim adjustments.



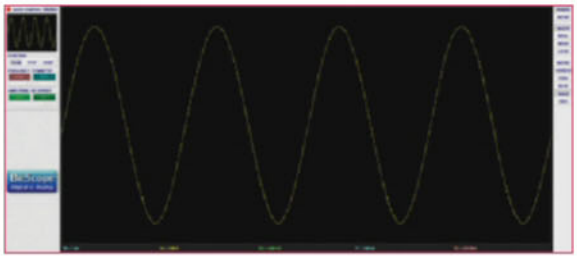
12 Familiarise yourself with pinout

The image above shows the BitScope Micro pinout diagram. There are a total of ten pins with two of them being ground pins (GND). The remaining eight pins can be configured as logic pins and four of them also have different functions – L4 is also a waveform generator (AWG), L5 is a clock generator, (CLK) and L7 and L6 relate to CHA and CHB respectively.

Transform your Pi into a micro oscilloscope

13 Perform a sample experiment

The easiest way to test whether or not your BitScope is working correctly is to connect one of the test clip grabbers to the analog input CHA on the BitScope. Connect the other end to physical pin two on your Raspberry Pi and adjust the scale of the y axis to 2V/div. You should then see an output in the main window of around five volts.



14 Use different waveforms

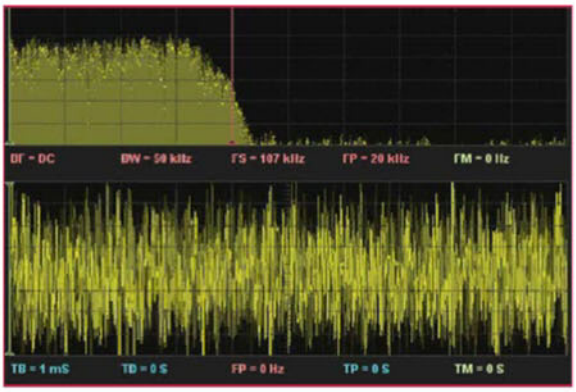
The BitScope can generate its own waveforms. Connect a female-to-female jumper cable between CHA and L4 (AWG). On the right-hand side of the DSO interface, select Wave and then a wave should appear in the main screen. Change the x axis to 100us/Div and the y axis to 500mV/Div. Right-click on the yellow OFFSET button and select MEDIAN. The wave should now fill the main window as in the above screenshot. You can adjust various parameters of the waveform in the wave control panel top-left and can also change to step (square) or ramp (saw-tooth) waves instead of tone (sinusoidal).

15 Experimenting with your body

Another interesting (but fairly simple) thing to try is measuring electrical signals from your body. Set the vertical axis to 1V/Div and horizontal to 20ms/Div. Then plug in one of the probes to CHA, pull back the grabber end and touch it with your finger. You should then see a sine wave on the screen. Bizarrely, this wave is actually radio waves emitted by your mains electrical wiring which are then being picked up by your body (which is acting as an antenna). This is why the wavelength of the signal you see is approximately 50 to 60 Hz.

16 Programming your BitScope

The BitScope DSO and other available software (BitScope Logic and BitScope Chart) are very powerful applications for a lot of experimentation. However, in some more complex monitoring environments they may not offer enough flexibility. The good news is that you can program the BitScope in C/C++, Python or Pascal using their programming API.



17 Further experiments to try

This tutorial has shown only a small fraction of what the BitScope Micro is capable of. As seen in the above image it can also be used as a spectrum analyser along with a whole host of other functionality. Perhaps for your next experiment you could measure the resistance of your body by comparing the voltage drop across your body with that of a known resistor. Or you could try probing your I2C or SPI connections to see how they work. If you ever run out of ideas, then why not visit the BitScope website and start experimenting further!

Above The experiment uses your body as an antenna to pick up radio emissions from your house

Mains electrical frequency

We looked at a signal from your body caused by radio emissions from the mains power supply in your home. In Europe the mains frequency is 50 Hz and typically with a voltage of 230 or thereabouts. In USA and some parts of Asia, the mains frequency is 60 Hz with a typical voltage of 110. Most modern electrical equipment is therefore capable of operating at either voltage or frequency.

Turn your Pi into a motion sensor with SimpleCV

Learn how to implement facial recognition into your Raspberry Pi using Python and a webcam

Joey Bernard
As a true renaissance man, he splits his time between building furniture, helping researchers with scientific computing problems and writing Android apps

Why Python?

It's the official language of the Raspberry Pi. Read the docs at **python.org/doc**

Back in issue 142, we looked at using the Kinect with the Raspberry Pi. But not everyone has access to this kind of hardware. Another class of project that is popular with Raspberry Pis is using USB cameras to create monitors of one form or another. A lot of these projects use command line applications to talk to the USB camera and generate images or movies that are used as part of the system. But what if you are writing your own program in Python and you want to add some form of image system to your code? Luckily, there are several modules available for you to choose from. In this article, we will take a look at using SimpleCV to get your program to talk with the USB camera. SimpleCV is built on top of OpenCV, making it easier to use for common tasks. Assuming you are using Raspbian, you can go to the main page for SimpleCV (**www.simplecv.org**) and download a DEB file. To install it, you can simply run:

```
sudo dpkg -i SimpleCV-1.31.deb
```

Before you do, however, you will want to install all of the dependencies. You can do that with the command:

```
sudo apt-get install python
python-support python-numpy
python-scipy ipython python-
opencv python-pygame python-
setuptools
```

You can check that everything worked by running the command 'simplecv' at the command line. This will start Python up and run the interactive shell that is provided by the SimpleCV module. You can then try connecting to your USB camera and pulling images from it.

Now that everything should be up and running, how do you actually use it in your own code? You can load all of the available functions and objects into the global scope with the command:

```
from SimpleCV import *
```

Making sure that you have your USB camera plugged in, you can now create a camera object with:

```
cam = Camera()
```

This will load the required drivers, and initialise the camera so that it is ready to start taking pictures. Once this object creation returns, you can grab an image from the camera with:

```
img = cam.getImage()
```

At least in the beginning, when you are experimenting, you may want to see what this image looks like. You can do this with:

```
img.show()
```

You will, of course, need to have a GUI up and running in order to actually see the movie. Otherwise, you will get an error when you try and call 'img.show()'. Don't forget that you can always pull up documentation with commands like:

```
help(cam)
help(img)
```

> SimpleCV is built on top of OpenCV, making it easier to use for common tasks

With the 'Image' object, you can do some basic processing tasks right away. You can scale an image by some percentage, say 90%, with 'img.scale(90,90)'. You can also crop an image by giving it a start location and saying how many pixels across and how many up and down you want to crop to. This looks like 'img.crop(100,100,50,50)'. SimpleCV has the location (0,0) as the top-left corner of an image.

The really interesting functionality in SimpleCV is the ability to find features within an image and to work with them. One of the clearest features you can look for is blobs, where blobs are defined as continuous light regions. The function 'img.findBlobs()' will search the captured image for all blobs and return them as a FeatureSet. You can set the minimum number of pixels to consider a single blob, the maximum number of pixels, as well as a threshold value. If you are looking at a region that has some hard edges, you can use the function 'img.findCorners()'. This function will return a FeatureSet of all of the corners within the captured image. A very simple monitor program could use one of these functions to see if there is any motion happening. If there is, then the set of blobs or corners will change from one frame to another. Of course, a little more reading will lead you to the 'img.findMotion()' function. This function will take two subsequent images and see if any motion can be detected going from one to the other. The default method is to use a block matching algorithm, but you can also use either the Lucas-Kanade method or the Horn-Schunck method.

The above methods will let you know some features of the captured images, and if any kind of motion has occurred. But what if you are more interested in identifying whether people have been moving around? Maybe you have an area you need to secure from espionage.

You can look for blobs – continuous light regions

In this case, you can use the function 'img.findSkintoneBlobs()'. You can use a binarise filter threshold to set what constitutes a skin tone. If you need to do more, you have access to all of the underlying OpenCV functionality. One of these more advanced functions is face recognition. You can use the function 'img.findHaarFeatures()' to look for a known type of object. If you wanted to look for faces, you could use something like:

```
faces = HaarCascade("./SimpleCV/Features/HaarCascades/face.xml","myFaces")
img.findHaarFeatures(faces)
```

When you start developing these types of programs, one thing that might come into play is timing issues. You want to be sure that your code is fast enough to catch everyone that may be moving through the field of the camera. In order to figure out what is costing time, you need to be able to profile your code. The shell in SimpleCV provides a feature called 'timeit' that will give you a quick and dirty profiling tool that you can use while you are experimenting with different algorithms. So, as an example, you can see how long the 'findBlobs()' function takes on your Raspberry Pi with something like:

```
img = cam.getImage()
timeit img.findBlobs()
```

Once you find and fix the bottlenecks in your code, you can create the end product for your final version.

With this article, you should now have enough to start using cameras from within your own programs. We have only been able to cover the bare essentials, however, so don't forget to go check out the documentation covering all of the other functionality that is available in the SimpleCV module.

Full code listing

```
# SimpleCV provides a simple interface to OpenCV
# First, we will import everything into the local
# namespace

from SimpleCV import *

# Make sure your USB camera is plugged in,
# then you can create a camera object
cam = Camera()

# Getting an image from the camera is straightforward
img = cam.getImage()

# You can rescale this image to half its original size
img2 = img.scale(50,50)

# There are several features that you may want to look at

# You can extract a list of blobs
blobs = img.findBlobs()

# You can draw these blobs and see where they are on
# the image
blobs.draw()

# or a list of corners
corners = img.findCorners()

# If you want to identify motion, you will need two
# frames
img2 = cam.getImage()

# You can get a FeatureSet of motion vectors with
motion = img2.findMotion(img)

# Face recognition is possible too. You can get a list of
# the types of features you can look for with
img.listHaarFeatures()

# For faces, you can generate a Haar Cascade
faces = HaarCascade('face.xml')

# Now you can search for faces
found_faces = img.findHaarFeatures(faces)

# You can load image files with the Image class
my_img = Image('my_image.jpg')

# You can save images to the hard drive, too
img.save('camera.png')
```

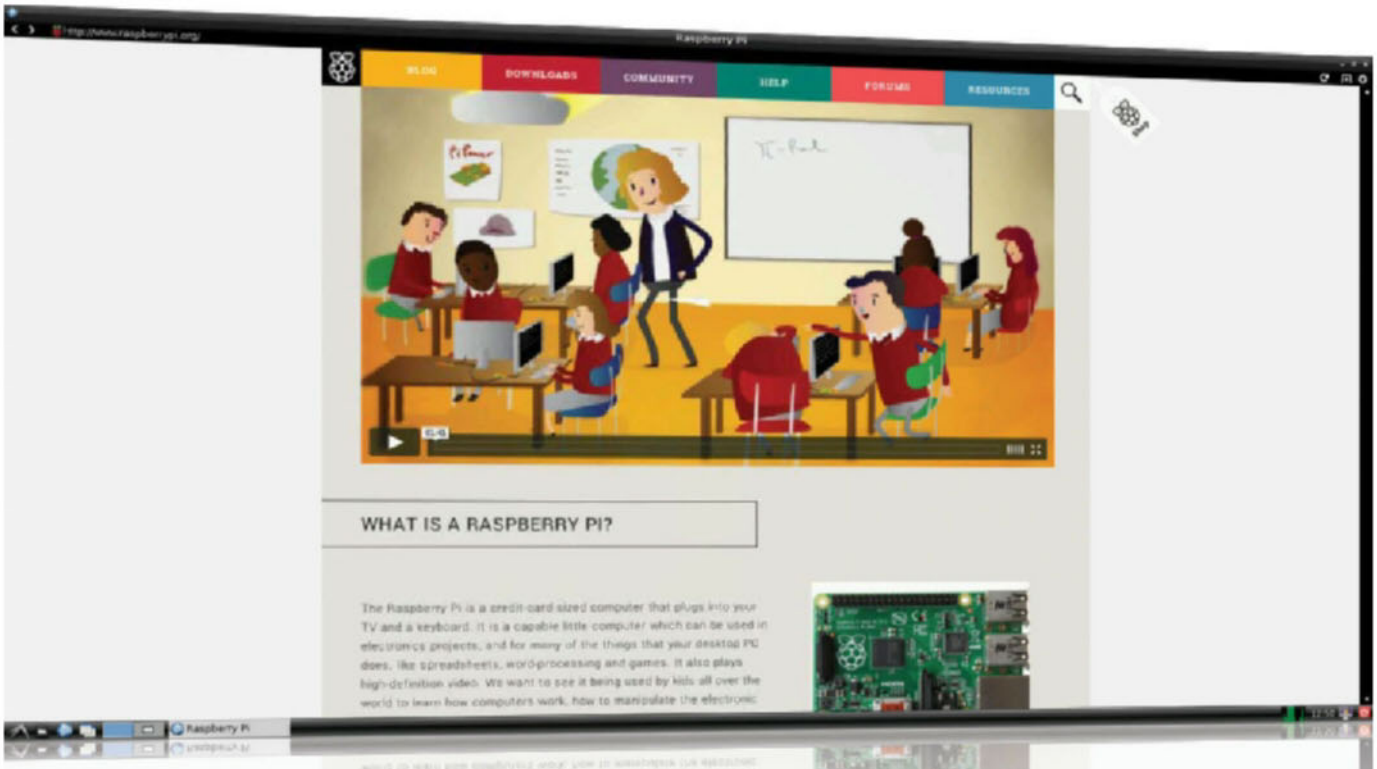
Above Any basic USB webcam or surveillance monitor will do for this

Importing

SimpleCV is built on top of OpenCV and provides a simplified set of functions. But what can you do if you have more complicated work to do? You always have the option of using OpenCV directly to gain access to the full set of functions. You can import the module into the local namespace with:

```
from cv2 import *
```

Not only do you have the usual image manipulation functions and the feature recognition tools, but you also have the ability to process video. You can use meanshift and camshift to do colour based motion detection. There are functions to look at optical flow. These look at apparent motions in a video, from one frame to the next, that are caused by either the object moving or the camera moving. You can even subtract the background from a moving foreground object. This is a common preprocessing step in vision systems. You can even construct 3D information from a set of stereo images gathered by a pair of cameras. With OpenCV, you really can deal with almost any vision problem you might be tackling.



What is the new browser?

The main Raspberry Pi distro has a new browser, but what is it and what makes it better than the previous version?

Rob Zwetsloot models complex systems and is a web developer proficient in Python, Django and PHP. He loves to experiment with computing

If you like this…
The new Pi browser is based on GNOME's Epiphany. You can find tarballs here: **bit.ly/1E8bSE1**

Further reading
One of the browser's developers has written a blog post with all the technical details: **bit.ly/YYh5xX**

I hear there's a new browser for the Raspberry Pi. Is this really a big deal?
Absolutely! The Raspberry Pi has such limited resources that any new, custom apps for it that help it work just that little bit better are always welcome. As much as we love the original browser, this really frees up processing power.

Oh, so it's a custom browser specifically for the Raspberry Pi?
Basically, yes. It's based on another browser with slightly different technology and modified to run faster and better on the Pi than the original browser, or the browser that was already on the Raspberry Pi.

What was the original browser, again?
The new browser is replacing Midori, which has been on Raspbian since the very beginning. Midori is well-known among the open source and Linux community as a very quick browser that does not use many resources at all. This made it a good fit for Raspbian at the time but it's still not the fastest browser in the world.

Okay, so what have they named this new browser, then?
Well it doesn't really have a proper name just yet. It's based on GNOME's Epiphany Browser that is usually just called Browser in GNOME itself.

Why do they just call it Browser?
The current GNOME desktop style is to name everything extremely simply. Browser, Software and Accounts are just a few examples. It's part of their effort to make the GNOME shell accessible – although it doesn't really relate to the Raspberry Pi at all.

Okay, well I'll call it Epiphany then. Why didn't it come to Raspbian before?
It wasn't light enough for the Pi to begin with. There is an ARM release of it in Debian so feasibly you could have installed it to the Raspberry Pi – however, Midori not only would have worked a lot better, it also has a bit more functionality.

More functionality?
Yes, GNOME's Epiphany browser is very minimalist. It serves its purpose for a lot of people but it only has the bare minimum features outside of actually loading web pages. It does render these pages properly though and will at least open new tabs.

Does the Raspberry Pi version have more features than the original?
Not really. Compared to the normal version of Epiphany it's just about the same, but due to all the tweaks and optimisations it runs a lot better than Midori currently does. There's not really that big of an expectation that people will be using the Raspberry Pi as their main portal to the internet, though.

I suppose that's true. What kind of optimisations were made then?
One of the big changes was a switch to Webkit1. Webkit is an engine for running web browsers that used to be in Chrome/Chromium and is currently used in Safari. Webkit1 does not use multiple processes, which means it runs better on the Raspberry Pi.

Other upgrades have been made by porting and optimising the way Java is handled, using the custom OXM player to perform hardware acceleration on video playback and various other small memory and CPU tweaks to make it run better.

Wow, okay. That seems like a lot of work. How does it perform?
We haven't had a chance to use it extensively at the time of writing, but it is definitely faster than Midori for some general browsing.

Sounds good. How can I get it on Raspbian?
By the time this has been published there will probably be a newer version of Raspbian with it preinstalled by default. If you don't want to write a new card then you can always update your version of Raspbian first and then install Epiphany by using the following:

```
sudo apt-get update
sudo apt-get dist-upgrade
sudo apt-get install epiphany-browser
```

RasPi magazine now on Android

RasPi mag issue three is now on the Play Store. Check out these competition entries whilst you wait for it to download

We've been listening to your cries since RasPi mag came out, and we've finally been able to get it onto the Google Play Newsstand so you can read it on all your Android devices. You can get RasPi issue three right now for only 69p/99c – grab it from the Play Store here: **bit.ly/1nRozP6**.

We've also been running a competition for the past couple of months for people to send in pictures of their Pi projects and win a Makeblock robot. The winner was the excellently named Chad Norris with his scorpion robot project. Here are some of the other excellent entrants from the contest:

@theuberchad

"Almost ready to have the scorpion bot controlled by its #RaspberryPi brain. #raspimag"

Check out Chad's full servo test of this Pi-powered hexapod at: youtube.com/watch?v=Ru9H4GxTn04.

@windfallprophet

"Twitter activated shot dispensing bot! #RaspberryPi + #Bartendro project made for a friends bar. #ShotBot #RasPiMag"

Having been Kickstarted last year, Bartendro is putting Twitter to good use in bars worldwide.

@ToneSibley

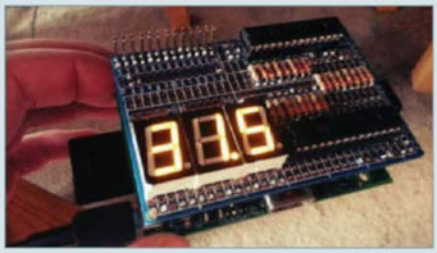
*"#RasPiMag Custom ambilight setup using Raspberry Pi, still needs tweaking but I'm pleased so far! **youtu.be/E01pVxz8krY**"*

This beautiful project makes use of the Lightberry kit, available from http://lightberry.eu.

@CodyErekson

"#RasPiMag Meet @RoboPaulLives, my #raspberrypi powered robotic psychic octopus. :)"

The 2010 World Cup result-predicting octopus Paul has been rebuilt – better, faster, stronger…



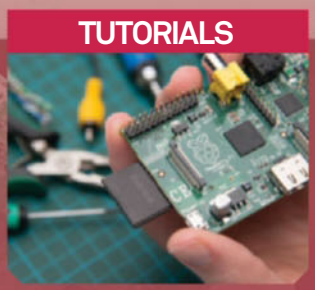
@AverageManvsPi

"That's my ProtoCam Kickstarter board with the 8x2 added. Will be a cam menu with a couple of buttons, finishing this week #RasPiMag"

Average Man's prototyping board will enable you to easily build up camera module projects.

RasPi

Digital magazine for Raspberry Pi makers



Download the **free** app on iTunes for iPhone and iPad now

www.linuxuser.co.uk/RasPiCode

facebook.com/LinuxUserUK

#RasPiMag

Reviews

GROUP TEST

Raspberry Pi Operating Systems 2014

Most people stick with Raspbian, but is that really the best OS for your Pi? Find out in this six-page super test!

Pidora

The Raspberry Pi Fedora Remix has come a long way since its initial launch, where it lost ground to Raspbian due to its sluggish, buggy behaviour. The new Pidora 2014, built for ARMv6 architecture and featuring packages from Fedora 20, is impressive at first glance – but are the changes only skin deep?

Download: bit.ly/1yqRTQM

RISC OS Pi

A legacy of days gone by, RISC OS Pi is a distribution of the classic RISC OS for your Raspberry Pi. Developed by Acorn Computers for use on the ARM chipset that they also designed, RISC OS was forked after Acorn Computers was broken up in 1998 and it's a continuation of this project that lives on in RISC OS Pi.

Download: bit.ly/1vbremd

Arch Linux ARM

For the ultimate in resource-light, custom-built operating systems, nothing beats an Arch setup – that is, if you know how to set it up. The barrier to entry is steep with Arch, but if you're looking to really learn the inner workings of Linux systems then few others will give you quite the same opportunity.

Download: bit.ly/1yqS2Uj

Raspbian

The Pi community's distro of choice (with a little help from the Raspberry Pi Foundation), Raspbian is popular for a reason. We cast a critical eye over this Debian-based OS to see just what the real advantages and disadvantages are with this distro, and whether it still stands up against the challengers.

Download: bit.ly/1spHsdp

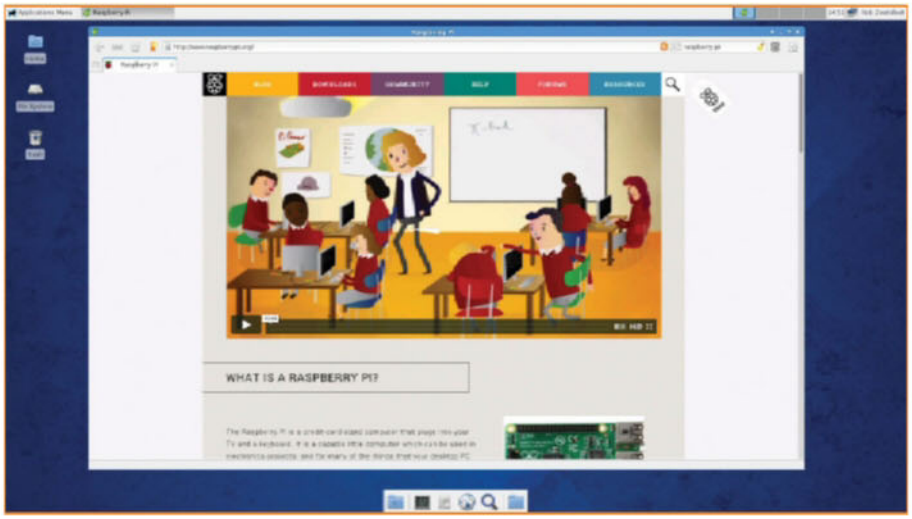
Pidora

One of the newest Pi distros is based on the popular Fedora. Is it the best choice?

There was a spin of Fedora for the Raspberry Pi during the early days of its release, but that was quickly dropped in favour of Raspbian when it proved to be a bit slow and buggy. It was almost two years after this incident that a proper version of Fedora was released on the Raspberry Pi in the form of Pidora. An almost straight-up port of the codebase to the specific ARM architecture of the Pi, Pidora has had a few tweaks to let it run on Pi hardware without much loss in performance, at least.

The very first thing to note is that the problems of Fedora on the Pi in the past are long gone. This is a very mature operating system that is stable and generally runs well on the Raspberry Pi. In terms of speed, it's not as fast as Raspbian or Arch Linux and in the case of Raspbian this may be due to a number of factors. Pidora uses Xfce, for one, which is known to be a little heavier than the LXDE that Raspbian uses. Fedora also uses much newer software that is somewhat designed to be run on computers which are slightly more high-end, while Raspbian is based on an older version of Debian with more lenient software. It isn't the biggest difference but it all adds up with the other problems.

Booting from NOOBS is painfully slow and prone to errors – something that doesn't occur with Raspbian or the other distros on NOOBS. Installing straight from the image removes this problem but, unfortunately, Pidora has one other disadvantage over Raspbian: lack of software.

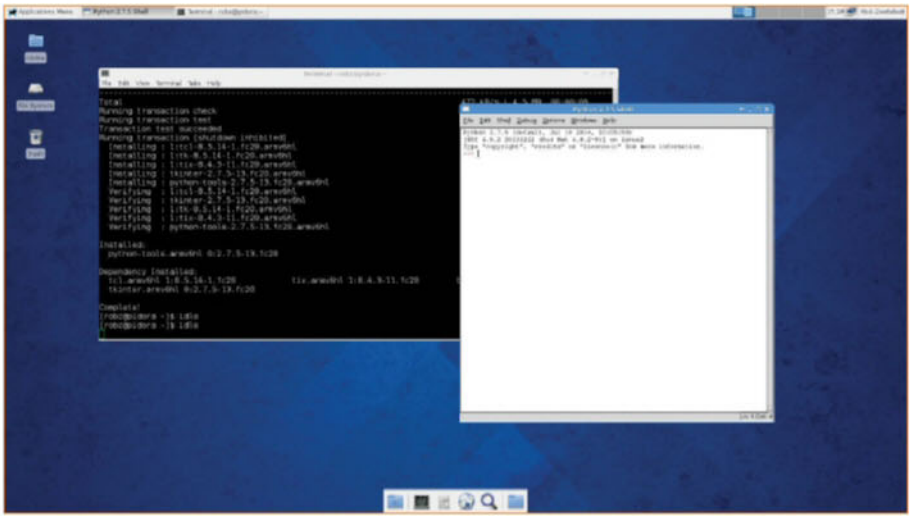


Pidora is more mature than the version of Fedora on the Pi from yesteryear

More software is being added all the time but a lot of basic or useful yet obscure packages available for Raspbian just aren't in the repository. The essentials are there and there are plenty of programming choices, but combine this with a lack of official Pi accessory support and it becomes less attractive for project work.

It's definitely not a bad distro, though. If it had ended up being the default when the Pi launched then we'd likely be saying similar things about Raspbian. However, there's very little reason to use it over its Raspbian counterpart.

> "A lot of basic or useful yet obscure packages just aren't in the repository"



Other operating systems are faster but at least Pidora is stable enough

SCORES

Updates	Pidora is kept up to date for the moment, however there's no guarantee it will stay this way	7
Useability	The installation is superior to Raspbian's and Xfce is a more useable desktop	9
Educational tools	You can easily program on Pidora but there are no specific tools to aid in learning it	3
Flexibility	As flexible as any Fedora distro but limited by its package choices and lack of Pi accessory support	6
Overall	We do really like Pidora but for everything you'd want to use a Raspberry Pi for, Raspbian or Arch is just better	6

RISC OS

The Acorn Computers OS keeps on going and keeps on being updated

The last time we did a Pi OS group test we slightly enjoyed the blast from the past that was RISC OS, remembering our time in school using Acorn Computers that our Tesco Computers for Schools vouchers paid for. We came away realising that the tint on our rose glasses was a bit strong and struggling to get any screenshots off the SD card.

Since then, RISC OS has been updated a few times, increasing the amount of available software, improving the performance of the OS and finally letting us easily export PNG screenshots for this article. It's still very much the same RISC OS though, a curious novelty from another time that doesn't really fit in with the ecosystems of modern operating systems.

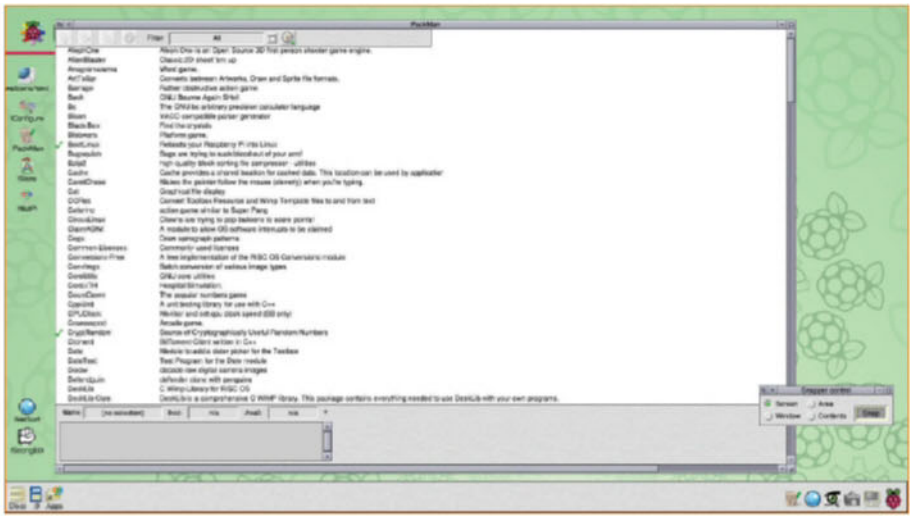
While RISC OS is not Linux it does have a similar file structure and uses a package manager, but otherwise it is completely its own thing. Using RISC is different from other operating systems as it uses a three-button system for clicking and opening menus, unlike the two-button standard of today. This can be confusing for new users, along with the way apps open on the desktop and the way they don't always require double-clicks to launch. When it is in a fullscreen window, it covers the panel and a whole host of other quirks. If you're used to the traditional desktop metaphor there are a lot of new workflow processes to get your head around for something you're unlikely to use as your main computer.

Diving into RISC OS is like time travelling back to three decades ago

As for teaching tools there are very few. You won't really be learning to code on here unless you like using BASIC or already have a bit of knowledge in Perl or C. You can access the GPIO port but it's not very well suited for all projects; Raspbian and Arch would be better.

Things have changed in the 18 months since we first checked out RISC OS on Pi, but it's either not enough or it's just never going to go in the direction of Raspbian. It's definitely interesting, though, so if you have a few hours to play with it then we recommend giving it a shot.

"While RISC OS is not Linux, it does have a similar file structure"



There are a lot of different systems and processes to get your head around

SCORES

Updates	Surprisingly, RISC is kept well up to date for a distro we can only imagine is not very popular	6
Useability	RISC is fine to use but it's just that little bit different to what a lot of people are accustomed to	6
Educational tools	Basically none are included with RISC and nothing can really be installed for this	2
Flexibility	With some perseverance and know-how you can use it for a few projects but less than others	3
Overall	RISC OS is a very different operating system to the others on this test, which isn't a bad thing but it is not conducive to education	4

Arch Linux

Not quite Linux from scratch, but near enough as Ras Pi operating systems go

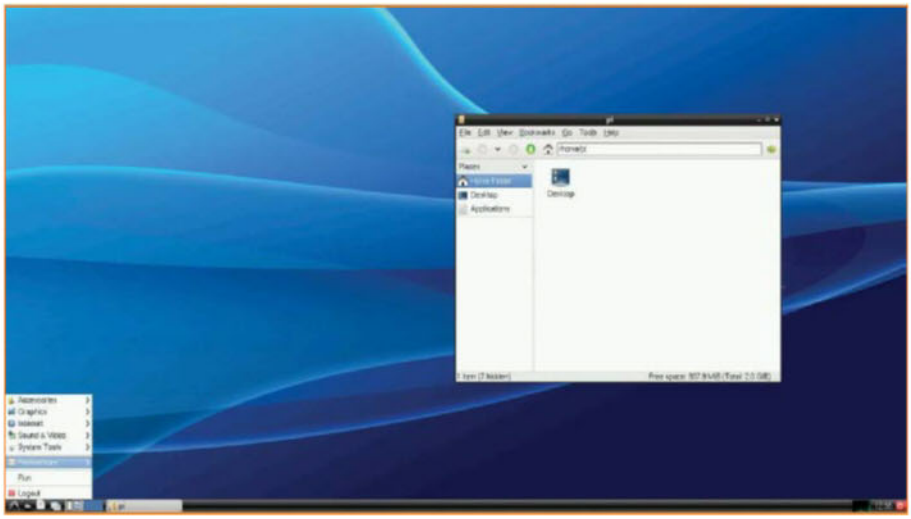
For just about as long as there's been a Raspbian distro on the Raspberry Pi Foundation's site there's also been an Arch alternative for those a little more adventurous in their choice of operating system. Whereas Raspbian gets you going straight away with an excellent selection of apps, Arch provides users with a command-line interface and only a bare smattering of extra packages over the Linux kernel to make it work.

Arch has the bare essentials available to be built upon for a perfectly customised distro. To that end, this version comes with the pacman command line package manager to help you install any available software from the repository including desktops, media players and others. It enables you to have no bloat on the system and the correct setup will always be faster than a modified Raspbian for a lot of projects or applications.

As for Ras Pi-specific functions, it does quite well in this regard too. The Pi camera board is supported and so are the GPIO pins – the latter allowing access to a huge number of Pi accessories, including Adafruit screens and sensors and other physical devices. Some of it can be trickier to use, as you can't rely on pre-built Raspbian software, but it is doable with some of the more complex additions.

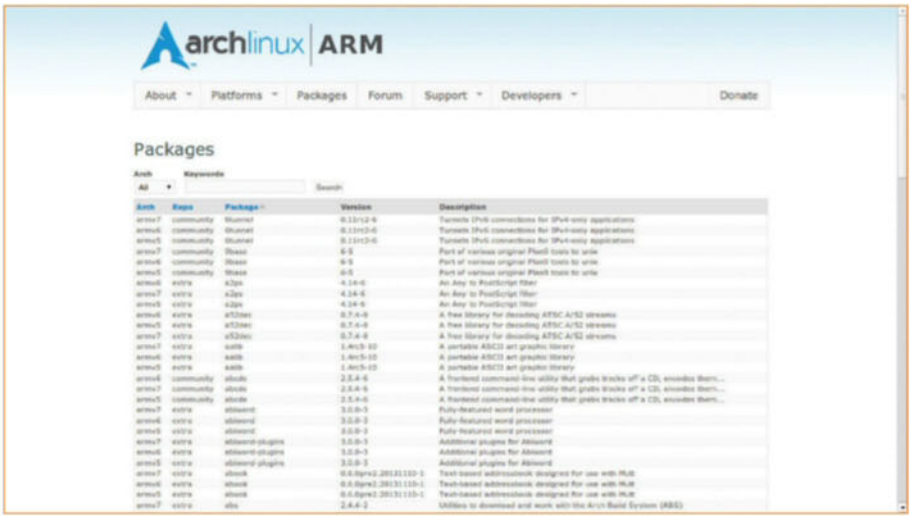
For normal users, though, it can be quite terrifying. All knowledge is assumed and, while you can easily find some quick tutorials to get started, it can be quite daunting. Even adding the Pi camera software takes a lot more effort than enabling it in the config menu. It does offer a unique opportunity to learn the intricacies of Linux, at least – which does keep in line with the Raspberry Pi education ethos – but there are a lot of one-off commands that might get lost in the process of getting it from zero to desktop.

For extremely custom projects you may well be better off using Arch over Raspbian. However, for a lot of users there won't be much of a difference in performance.



Arch Linux isn't clunky, it has the bare necessities available for full customisation

> "While you can easily find quick tutorials to get started, it can be daunting"



Be careful with one-off commands as they can easily get lost in the many processes

SCORES

Updates	As a rolling release that is heavily tied to the Raspberry Pi, Arch gets a lot of updates	8
Useability	It's difficult to get into unless you're well versed in the ways of Linux	4
Educational tools	Using Arch is educational in itself, but it's more further education than a beginner's guide	7
Flexibility	About as customisable as it can be thanks to being built from almost scratch	9
Overall	Arch is excellent in its own way but it's definitely not for everyone and really not the best distro for something like the Raspberry Pi	7

Raspbian

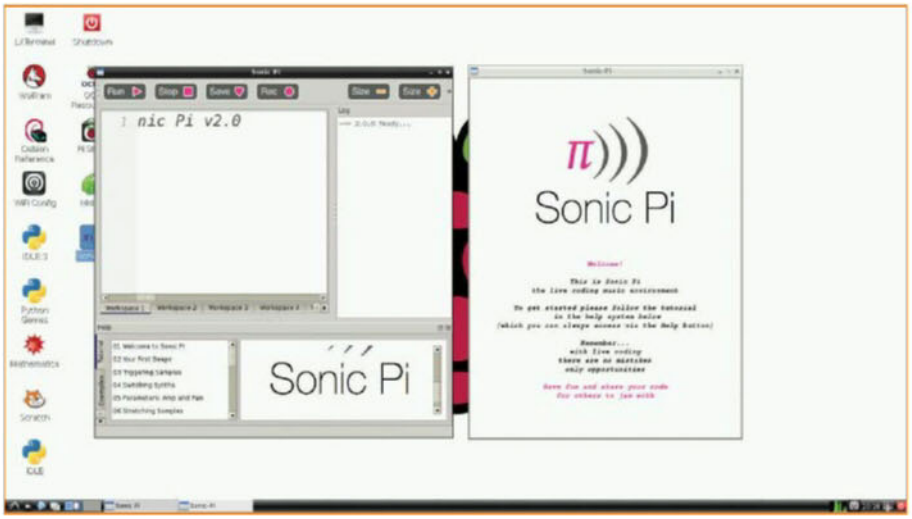
The primary distro for the Pi gets a lot of love from the Raspberry Pi Foundation

There's no secret as to why Raspbian is the recommended Raspberry Pi distro: it's obviously an easy-to-use distro that can be set up relatively quickly. Thanks to the support of the Raspberry Pi Foundation, it gets a lot more development and attention from the community than any other distro for the Raspberry Pi.

The Debian base of the distro is in no small part responsible for this. It's easy to maintain, and if you ever need to delve into the terminal then the commands are simple and quick enough to use. There are also plenty of software choices through the repositories, which include the majority of the apps you'd use on your main computer; whether or not they're useable on the limited resources of the Pi is another matter.

The major advantage of Raspbian over the other distros is the selection of educational and teaching material included on the distro. From simple software such as Scratch and Sonic Pi that teach coding fundamentals through to a full-on OCR computing course, there are a lot of apps on here that you don't get anywhere else. It also supports all the recommended overclocking limits, the Raspberry Pi camera and any future official hardware add-ons as well.

A benefit of using Raspbian is that a lot of tutorials, projects and third-party hardware run off or are based on it as a standard. It makes it easier to learn coding if that's your goal, or even to replicate these projects if you're not particularly confident in your skills.

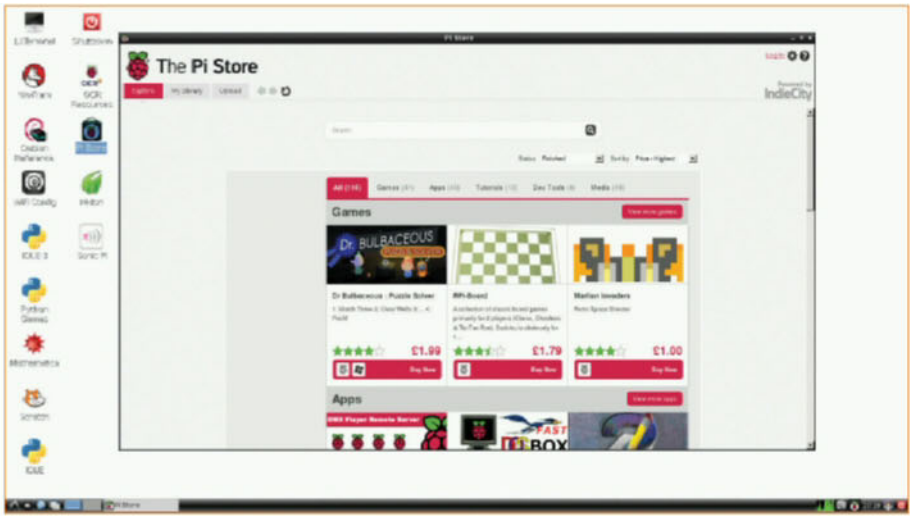


Raspbian is the only place you'll be able to use Sonic Pi

Otherwise the distro is quite fast and light. The browser was recently updated to a custom piece of Epiphany-based software that is noticeably faster than the previous Midori effort (see page 84). Raspian's other custom pieces of software are great at improving its performance but are unique to Raspbian, such as the command line OXM player for playing video and audio.

It is essentially the default Linux distribution and this status has given Raspbian a lot of advantages over everything else while still being as flexible as Linux can be.

> "There are also plenty of software choices through the repositories"



There is plenty of material and software available for Raspbian

SCORES

Updates	Raspbian is kept up to date well with the latest Pi software and firmware updates	9
Useability	Definitely the easiest Raspberry Pi distro to use, although it does have to use quite simple software	8
Educational tools	There's an entire curriculum on Raspbian and a lot of software to learn with	10
Flexibility	It's not as light as something like Arch but it can still be used in a wide variety of applications	6
Overall	It's an excellent distro which is designed around all the Raspberry Pi's strengths	9

In brief: Compare and contrast our verdicts

	Pidora 2014		RISC OS Pi		Arch Linux ARM		Raspbian	
Updates	Currently fully up to date, but was only released quite recently	7	Well up to date, considering its low popularity	6	Frequently updated, being based on a rolling release	8	Updated with the latest software and firmware	9
Useability	Better than Raspbian and Xfce is a better desktop on Pi	9	Different workflow style might inhibit some users	6	Difficult to use if not already experienced with Arch	4	Easiest to use, though limited to simple software	8
Educational tools	No specific learning tools are baked into the distro	3	None included and none are available to install, either	2	Configuring Arch is a great exercise for advanced users	7	A full suite of tools and resources is built into Raspbian	10
Flexibility	Pretty good but limited by its range of available packages	6	Takes a lot of effort to get the result that you want	3	Fully customisable as you build it yourself from the command line	9	Not as light as Arch on the Pi but still very flexible	6
Overall	**Very compelling, but not quite as good Arch or Raspbian**	**6**	**Different and interesting, but not a real educational tool**	**4**	**Excellent in itself but not the best choice for a Pi**	**7**	**Clear winner, designed around the Pi's strengths**	**9**

AND THE WINNER IS...

Raspbian

Pidora's strong performance raised an interesting point about these operating systems, and that's the degree to which they're supported by the Pi community. Having won the lead a few years ago, Raspbian has since enjoyed not only the full support of the Raspberry Pi Foundation but also the benefits of documentation – the majority of the tutorials you'll have found for the Pi use Raspbian and, because of this, its leading position has only become stronger.

However, looking at Pidora 2014 on its own merits and ignoring the Raspbian bias, it does have some key useability advantages over Raspbian. Not quite enough to make it better, but enough to make us think that this is going to be a real contender in the future.

An honourable mention goes to RISC OS, not only for its preservation of a classic OS enjoyed by many Linux users a few decades ago, but also for providing a completely different kind of desktop experience and helping young Pi enthusiasts discover more about the history of computing. It isn't, unfortunately, going to become our go-to Pi distro, but it's certainly good fun.

As for Arch, whether or not you choose to use this distro will really come down to your previous experience with it on Linux systems. If you know what you're doing – or are prepared to dedicate a substantial number of hours to learning how – then Arch can be the best choice for big, ambitious projects. The absolute control you have over the way you build Arch empowers you to really push your Pi with highly custom setups.

So for now we recommend that you stick to using Raspbian, while keeping a weather eye open for Pidora. If you're looking for a challenge, it's time to start learning Arch.

Rob Zwetsloot

A host of tools designed to teach kids to code are built into Raspbian

THE STORIES, STRATEGIES, HEROES & MACHINES

www.historyofwar.co.uk

HISTORY of WAR

Available from all good newsagents and supermarkets

ON SALE NOW

> Lincoln vs the South > Northern Ireland erupts > Victory at Agincourt > World War I

GREAT BATTLES

MILITARY MACHINES

HEROES OF WAR

SECRETS & INSIGHT

INCREDIBLE PHOTOS

BUY YOUR ISSUE TODAY

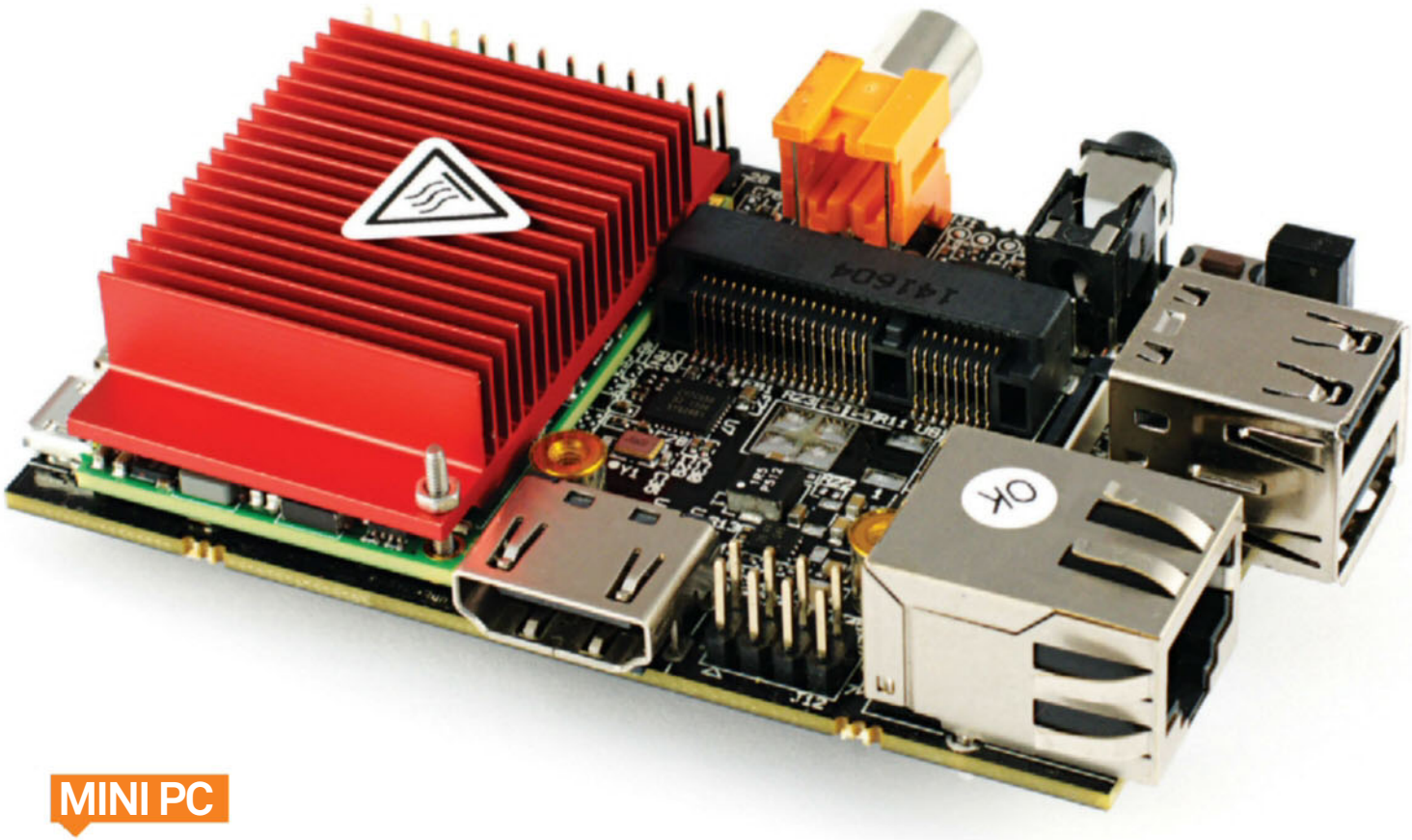
Print edition available at **www.imagineshop.co.uk**

Digital edition available at **www.greatdigitalmags.com**

Available on the following platforms

Print Tablet Phone Desktop

facebook.com/HistoryofWarMag twitter.com/@HistoryofWarMag



MINI PC

HummingBoard-i2eX

Can this publicly-released version of SolidRun's internal developer design, Carrier-One, dethrone the bestselling Pi single-board computer?

Pros
HummingBoard's performance is exemplary and the top-end model includes features are rare this end of the market

Cons
The large heatsink means most Pi GPIO add-ons won't work and prevents the board from fitting in most existing cases

Straight from the box, the HummingBoard-i2eX surprises: it packs the biggest factory-fitted heatsink of any similar device we've tested, a mighty aluminium block bolted to the processor and memory, which is responsible for the board's 23mm overall height and scale-tipping 71g weight – nearly double that of the Raspberry Pi. It also harms compatibility: Raspberry Pi add-on boards will not fit without the use of risers to the GPIO port and the HummingBoard-i2eX is too bulky for most – but not all – Raspberry Pi cases.

At first, the presence of the heatsink seems odd: rival boards do with no cooling at all, or have tiny heatsinks no larger than the chip on which it sits. During use, however, the heatsink's surface hit 75°C, explaining the presence of both the heatsink and the warning sticker that adorns its surface. It may also explain why the previously announced quad-core variant has yet to appear on the market.

The HummingBoard is, in fact, an entire family of devices. Unlike the Raspberry Pi from which they have undeniably drawn inspiration, the HummingBoards are not single-board computers (SBCs) at all, but computer-on-module (CoM) units with a carrier board, hence its original name 'Carrier-One'. As well as a choice of three processors – the Freescale i.MX6 Solo, Dual-Lite or Dual – the family includes two carrier boards. The base board is available on the i.MX6 Solo and Dual-Lite variants and matches the Raspberry Pi's feature set, bar the lack of DSI and composite video output; the top-end 'eX' board adds LVDS video, gigabit Ethernet, mSATA and mini-PCI Express connectivity, and is exclusively available with the i.MX6 Dual processor, which features a more powerful GC2000 graphics processor than the Dual-Lite variant's GC880.

In theory, there's no real reason for this: the CoM design, in particular the way it connects to the carrier board, is identical

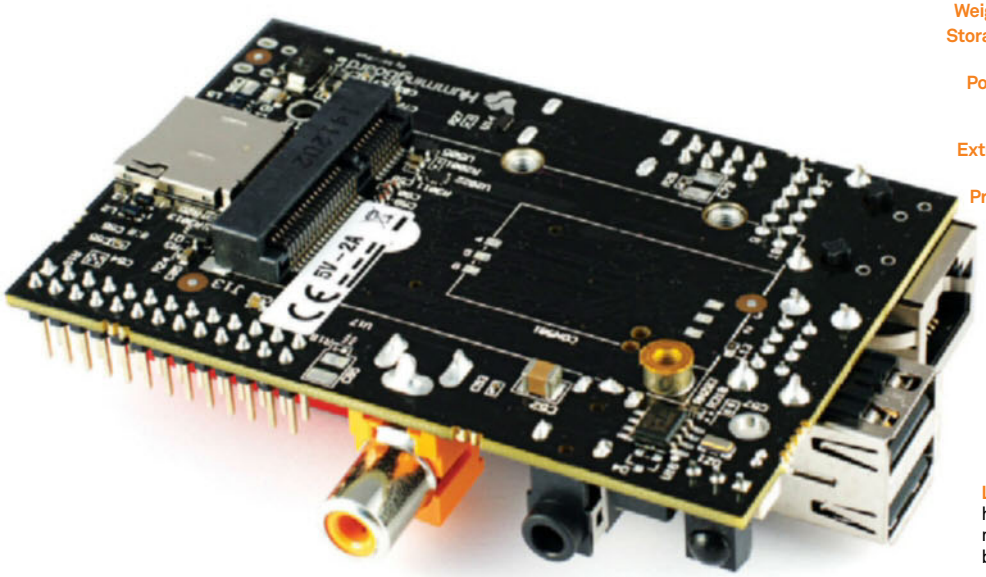
HummingBoard-i2eX

Can Carrier-One dethrone the bestselling Pi single-board computer?

REVIEW

Technical specs

Operating System	Android KitKat 4.4 (Debian, GeeXBoX, Ubuntu also available)
Processor	Freescale i.MX6 Dual 1 GHz ARMv7 (as computer-on-module)
Memory	1GB DDR3 RAM (as computer-on-module)
Dimensions	66.6mm x 93.1mm x 23mm including connectors
Weight	71g excluding cables
Storage	None on-board, maximum 128GB via micro SD Card plus mSATA support
Ports	2x USB 2.0, gigabit Ethernet, HDMI, co-axial S/PDIF digital audio out, 3.5mm analogue audio out, MIPI CSI-2, LVDS, mini-PCI Express, mSATA
Extras	26-pin GPIO header, 8-pin FlexCAN header, infrared receiver
Price	£89



Left The Hummingboard has a computer-on-module plus carrier board design

> "The presence of a heatsink seems odd: rival boards do with no cooling at all"

across all three available models of HummingBoard. This opens the door to the HummingBoard's real selling point: the potential. Should SolidRun choose to exploit it, the user can cheaply upgrade to a next-generation processor release simply by retaining their carrier board and replacing the CoM. If SolidRun travels that route, it will be a feather in its cap; if not, it's a wasted opportunity to bring some of the flexibility of traditional PC architecture to the hobbyist embedded space.

This upgradability would tie in well with the eX carrier board's mSATA and mPCIe ports, unique at this end of the market. The mSATA connectivity allows for a compact yet high-capacity solid-state drive (SSD) to be fitted to the underside of the board. The mPCIe slot meanwhile allows for a myriad of high-speed add-on hardware, including wireless radio modules, providing drivers compiled for ARMv7 are available.

The HummingBoard-i2eX was tested with two operating systems: Android KitKat 4.4 and Debian Jessie. The former was responsive and pleasing, with full access to the Google Play application store, but the latter really does unlock the HummingBoard's true potential.

A SysBench 95th percentile time of 22.94ms demonstrates the HummingBoard's capabilities, blazing past the Raspberry Pi's sedate 51.45ms and the 29.72ms of its AllWinner A20-based rival the Banana Pi. The multithreaded results are even more impressive, with 1.296s and 0.136s compress and decompress times for a 10MB test file, compared to 8.64s and 3.08s on the Raspberry Pi. But there is still a bottleneck present in the design: raw network throughput was limited to 371MB/s as measured on a gigabit network – below even the 470MB/s SolidRun warns customers of in the manual.

Gareth Halfacree

Summary

The HummingBoard is an undeniably impressive design and its computer-on-module layout suggests that upgrades will be possible in the future. The processor is fast, the mPCIe and mSATA ports useful, and the GPIO header familiar to anyone who has used the Raspberry Pi. The large heatsink makes the HummingBoard bulkier than its competitors, however, while also preventing easy use of add-on boards.

Also consider

CuBox-i4Pro
£124
If you don't need Raspberry Pi-style GPIO capabilities and have a little room in your budget, the CuBox-i4Pro boasts full software compatibility with the HummingBoard but with a more powerful quad-core processor and 2GB of RAM. Packed into a tiny cube, additional extras include optical audio output, eSATA and integrated Wi-Fi and Bluetooth radios.
newit.co.uk

Raspberry Pi Model B+
£27.44
The latest revision of the classic Raspberry Pi design, the single-core ARMv6 processor can't hold a candle to the Banana Pi despite the similar price. Its software ecosystem, however, is immeasurably more mature, while add-ons from piggyback boards to perfectly-fitting cases are easy to come by.
raspberrypi.org

More information
www.bananapi.org

DISTRO

Best for: Old computers

Webconverger 26

Minimum Specs: CPU x86 RAM 1GB STORAGE 1GB

Can this distro help you to transform your old computers and laptops into web kiosks and digital signs for safe use in public places?

Pros
Lots of features, easy to customise and low on resources. Efficient way to run info terminals

Cons
Configuration interface is easy to access from other browsers. Need to pay $200 to use configured setups

Webconverger is a browser-based OS (running on Firefox) that can transform computers into web kiosks or digital signage, such as the ones you'll see playing news channels or corporate slideshows in lobbies, or offering search/index tools and web-based apps in public places such as libraries or city centres. One of the key advantages of Webconverger over the myriad of other Linux tools and distros offering this same functionality is that it has a very small footprint, working with almost any standard x86 hardware with 1GB of RAM. This means it's an excellent way to repurpose old PCs and laptops to use in the spaces you want to get set up with a custom kiosk/signage network. Even better, it's incredibly simple to create a bootable USB stick with Webconverger so that you can transform computers on an ad hoc basis. When you run the distro, you'll see a blank desktop appear followed by a browser window – this is your web kiosk. Once it's running in a public place and accessible by passers-by, the only thing they'll be able to do is use the browser (with your customised configuration). Even if you've given them the ability to close it down, there's nothing else for them to interact with at all. This makes Webconverger ideal for situations such as a computer to provide free internet access in a café.

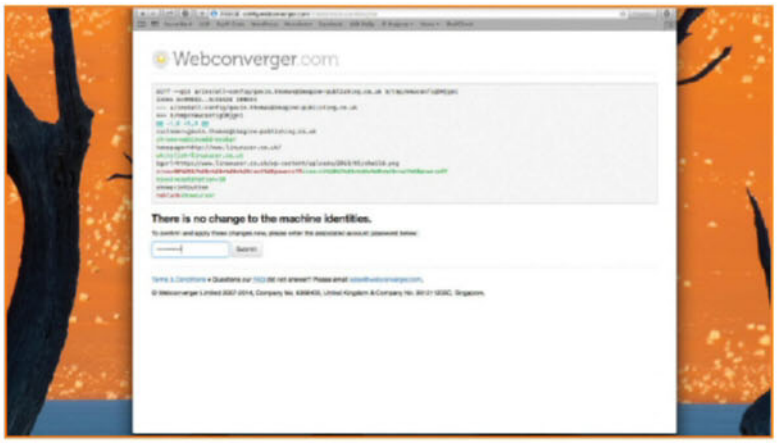
Customising the configuration is very easy. In previous versions the settings had to be made at the boot screen, which proved cumbersome, but since we last reviewed Webconverger this has been changed so that you can now customise all these settings through a web interface, and this also means that your configuration is stored between boots. Running Webconverger for the first time, the browser will take you straight to the interface, where you can add your email address (and then

Webconverger 26

Can this distro safely transform your old computers for public use?

REVIEW

New features: Firefox 32 • Proxy authentication • Security updates • Cron scheduler and printing fixed



You can edit the configuration from the web browser

Here's our LUD campus terminal running in debug mode

"Ideal for situations such as a computer to provide free internet access in a café"

confirm it) in order to create your configuration profile. From there, you add the machine identities of each computer you're running Webconverger on, nicknaming them as desired, and you can then manage multiple kiosks from this one interface.

Changing the configuration is straightforward as well, though there's a little reading to do on the developer's website about the API (**http://webconverger.org/API**). The documentation is pretty good but not well organised, so expect to go rifling through lots of different pages to round up all the various commands you'll want to use. You simply add API commands onto new lines in your configuration, hit submit and then enter your password to commit the changes, which are enacted on the kiosks on reboot.

The API commands themselves are very useful and wholly geared towards improving the kiosk experience. You can set multiple homepage tabs, filter websites through whitelists and blacklists, set up print servers and add a print button to the browser bar. You can use cron to schedule Firefox resets and even system shutdowns, and you can also change the browser interface to remove the URL and search bars, or display at fullscreen either by removing the chrome structure or turning it into digital signage via Neon. Neon used to be a separate digital signage service but is now based on the Webconverger platform, and you can access Neon Live separately via the boot menu as well as use it in this way through the API command.

A slight concern is the fact that, if you have a URL bar, you can access the configuration web page from the kiosk browser – as well as any other computer in the world, for that matter – and then view all of the configuration details; all you need to know is the email address used to create the profile. You can even try to change the configuration, though you won't get far without the password. However, because of the way that Webconverger is designed, with all of the browsing data being reset after each session or on a more regular, scheduled basis, this isn't a real security concern. Still, it's not exactly ideal.

All told, though, this does look like the complete package and it's far better than a lot of the competition, both paid-for and free. You can't really fault Webconverger for usability and speed, and all the features work just as you'd hope they would. We managed to get a cron schedule up to power our 'University of Linux' info terminal, sort out a basic proxy authentication, customise the desktop wallpaper to our own design and create a locked-in, browser-based experience around a few select web resources before digging further into the documentation. There are many advanced options available too, like the hidden terminal (if you're in debug mode), the ability to create screensavers and to get homepage videos playing automatically after a set period of inactivity. All of which left us with the impression that this is a genuinely useful tool to help you to create controlled public terminals to access the web. It's not something everyone will need, but for those that do then this is definitely your answer.

Gavin Thomas

Summary

Offers the customisation you need to create safe web kiosks and digital signs, and the configuration interface means simple management. But you're stuck with unconfigured setups unless you're willing to spend a cool $200 (£123 approx).

Download now

webconverger.com

Left The settings don't offer much control over what you can do in the browser

Pros
Lighter and faster on the Pi than any other web browser, modified to work on majority of websites

Cons
A lot fewer features than most other browsers, even when compared to the previous Pi browser Midori

SOFTWARE

Epiphany Web

The brand new replacement browser for the Raspi is based on the little known GNOME web browser: Epiphany

Using the Raspberry Pi for around the past two years has generally been pretty fantastic. It took us a year or so to stop being surprised by just how much it was able to do in the various projects we saw or made ourselves. One thing that we always struggled with was web browsing though; Midori was slow and laggy and it would take up all the Raspberry Pi's system resources as well.

It seems the Raspberry Pi Foundation has noticed this too and has been busy creating a new browser for Raspbian that's lighter and faster while still being a useable piece of software. Epiphany, the GNOME Web browser, is the result and is now replacing Midori in the latest versions of Raspbian.

First things first: there is a noticeable and quite large difference between the two browsers in terms of performance. Epiphany does not bring the Raspberry Pi to a halt and there's very little to no stuttering when browsing, even when a page is loading. This is quite the improvement over Midori in our experience, where even the Raspberry Pi website would cause the little Pi to struggle.

There is a trade-off for this better browsing experience, though, and that's a less feature-rich browser. Epiphany is incredibly basic, with its most advanced feature being tabbed browsing. While Midori is quite simple compared to Firefox and Chrome, it is at least quite customisable and supports a number of plugins. Epiphany only has the bare bones of browser functionality: history, bookmarks, a stop/refresh button, selecting a download location and some other very basic features.

It does render all the web pages you'll need, though. On a Raspberry Pi, that's not really that many; not having syncing bookmarks or an app store or super advanced privacy controls is not really going to be much of a concern when all you're really using it for is checking a tutorial or bug on the Pi. It's not going to be the main web browser in your life but Epiphany is good enough for the tasks that the vast majority of people will be using it for.

You can always install another browser onto your Pi if you want more functions, including Midori.

Rob Zwetsloot

Summary

Epiphany is not the best browser in the world but it's the best browser for people who don't really use a Raspberry Pi as their main computer. It's light and fast but very simplistic, however it will render pages properly and still let you use the Raspberry Pi as it does this.

Download now

bit.ly/1vaXp3R

Subscribe

Subscribe today & start saving
Non-USA readers see page 24

USA special offer

Subscribe today and get 5 free issues*

Your exclusive offer code: USA

Exclusive subscriber benefits

- Subscribe today and pay just $130 for 13 issues*
- Pay as little as $10 an issue – usually $16.99 in stores

For more information and to order visit
www.imaginesubs.co.uk/lud
Or call **+44 (0) 1795 418661**

Imagine Publishing publishes more than **20 monthly magazines**, some of which have been running for over **10 years**, reaching over **4 million readers** every year

***Terms and conditions:** This is a US subscription offer, please don't forget to quote USA when ordering. You will actually be charged £80 sterling for an annual subscription. This is equivalent to $130 at the time of writing, although the exchange rate may vary. Five free issues refers to the newsstand price of $16.99 for 13 issues being $220.87, compared with $130 for a subscription. Your subscription will start from the next available issue. This offer expires 31st January 2015.

a-JAYS Five
FOR ANDROID

JAYS®
www.jays.se

SELFRIDGES&CO hmv cleverkit.com Superfi amazon.co.uk

Contact us...

Web: www.linuxuser.co.uk
Email: linuxuser@imagine-publishing.co.uk

Facebook: Linux User & Developer

Twitter: @linuxusermag

Your questions answered

Send us your questions and we'll do our best to answer them!

Configuring wireless drivers

I'm running Mint 17 with a Plasma 5 desktop. This afternoon I saw the icon for Update Manager had disappeared from the system tray in the bottom right-hand corner of the screen. I hadn't done anything which would cause this – I was working on an LO Calc spreadsheet at the time.

I opened Update Manager from the menu and went to the Edit>Preferences>Icons tab. All the icon boxes showed a red cross. I selected icons for each one from my Pictures folder and clicked on Apply. I closed the preferences form and rebooted but when I went back into the icons tab of the preferences form, the change I had made hadn't been applied. I tried this several times, always with the same result. I tried changing preferences in other tabs and the same thing happened.

The Apply button on the preferences form appears not to be working. I went into package manager and reinstalled MintUpdate but that didn't fix it so then I removed MintUpdate completely, rebooted, reinstalled MintUpdate and rebooted again. None of it worked. For some reason I am unable to change the Preferences in MintUpdate. Do you know of any solution?

Mark

This could be a number of things really but it sounds like you're mainly having graphical issues with the Updater rather than anything else being the culprit though.

FAQ: Music matters

Q: What audio file types are open source?
A: There are a few but the biggest ones are Vorbis and FLAC. Vorbis is usually associated with OGG files which are similar to MP3s, and FLAC is a lossless codec for the highest quality sound.

Q: Is it legal to play MP3s on Linux?
A: It's a grey area and applies to other proprietary codecs as well. One of the most popular ways to decode audio is via Ffmpeg, which doesn't store the content of the file when playing it – this means it does not fall foul of some versions of software patents. So far nobody has gone after it.

Q: Why aren't open codecs more popular?
A: Some of them are, especially in the video space. There's a five or ten-year cycle with containers, codecs and file types it seems. It was MPGs 15 years ago, then AVIs and now MP4s. But MP3s may never be toppled with the advent of streaming services.

Below Plasma 5 is new and looks lovely, but it's still a bit buggy

Plasma 5 is still not quite stable so this could easily be the issue. Try out MintUpdater on the different desktops, especially Cinnamon or MATE if you still have them installed as they are the flagship distros for Linux Mint and the updater will work best on them. Also make sure you can actually do an update. Open up the terminal and do the following simple commands:

```
$ sudo apt-get update
$ sudo apt-get upgrade
```

These will upgrade your packages if everything is still working so at least you'll be able to do that. Otherwise you might need to run the update manager as root/sudo for the changes to stick, or you could always just try to create a new user in case your home folder is corrupted in some way.

Update Manager is also getting updates right now as well, so a future update for it may fix these issues. Hopefully one of these methods or waiting it out works.

How to burn an ISO

I'm very new to Linux and I have been trying to put a Linux ISO onto a disc but I've been having trouble. I've downloaded a number of ISOs, dragged them onto my disc and burnt it, but it doesn't work and will not automatically boot up when I restart my computer. Is there something I'm completely missing or am I being stupid?

Sarah Fox

We actually get this in every now and then and it's a legitimate question: if you don't know how to write a CD or DVD in this way then you wouldn't really know.

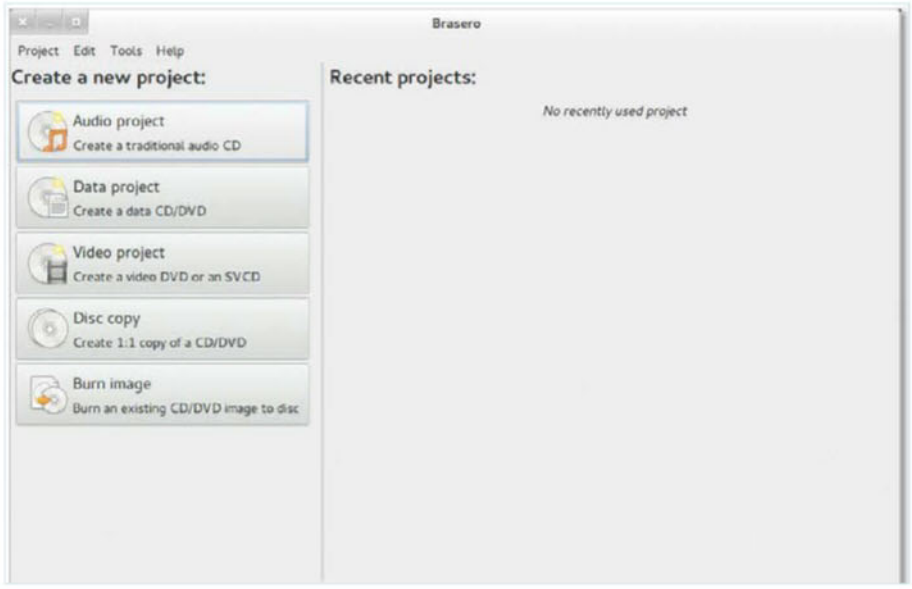
The main issue here is that you need to use special software to write an ISO to disc. On Linux we like to use an app called Brasero – if you have an older issue of this magazine then you will find it mentioned on pages 96-97, which detailed what's on each DVD before we launched FileSilo.

If you have a blank disc in your drive and know the location of an ISO, it will let you burn it properly to disc and then boot from it.

You may also have to double-check whether or not you have the disc drive set as a higher priority in the boot order than your hard drive in the BIOS. Failing that, you can usually press a key when you turn on your computer to choose what you boot from. It's usually labelled at the bottom of the screen during this time as Boot Menu.

Moving in BTRFS

I've recently converted an ext4 filesystem with 2.5TB of data to btrfs and I would like to have that data, now residing in the root of



Above Brasero is an easy to use application that lets you create and rip discs

Sourcing and installing pain

Hey, I'm trying to install CentOS 7 on my laptop and I'm having a problem: when I get to the INSTALLATION SUMMARY page I apparently lose my install source and I get the following error:

"Error setting up base repository."

I've tried using a USB drive and a DVD (two different downloads) and they both get lost at this point. I decided to try to change my INSTALLATION SOURCE to the internet but have had no joy. I have my NIC configured and it shows as connected but I can't get any movement on the install.

Googling this problem tells me that using a specific URL (**http://mirrors.kernel.org/centos/7/os/x86_64**) should allow the installation to proceed but I still get the repository error.

Am I missing something here?

Thanks.

Joe B

Unfortunately, it may be the case that you need to do a more basic install of CentOS before trying anything custom on some hardware. It's a weird bug that has been around for a little while and this may be the only solution for you.

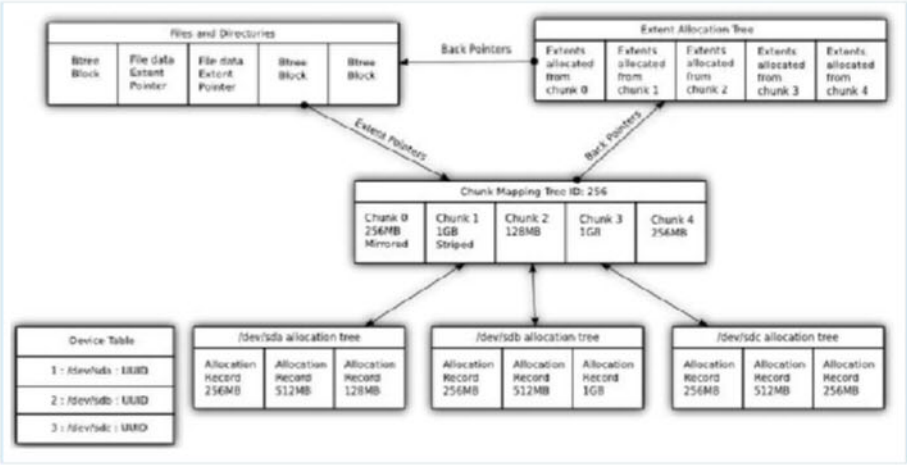
You might also keep trying to point it towards the CD/sr0 when the error pops up, but be aware that this doesn't always work. We hope you get it working in the end!

Above CentOS shares some common issues with Fedora and Red Hat

Questions & answers

Facebook: Linux User & Developer

Twitter: @linuxusermag



Above Btrfs is the future of file systems but the initial change needs to be done

the filesystem (subvolid 0) in a subvolume, so the subvolume can be snapshotted on a regular basis.

I'm new to using Btrfs and I'd like some opinion on the best way to move this data, and I haven't found any specific info on standard practice in this situation after the usual flurry of Google searches.

So would it be necessary to create a subvolume and move the data from the filesystem to the subvolume? Such as:

```
# btrfs subvolume create /mnt/subvol1
# mv /mnt/dir1 /mnt/dir2 /mnt/dir3 /
mnt/subvol1/
```

This takes ages, though. Is there a better solution to this or do I just need patience?

Bob

You are quite right – that will take quite a while; about the speed of transferring between two separate disks, so it will take some time to process.

Probably the best method is to create a subvolume and then reflink copies to this subvolume. It won't use any extra space, and it also then lets you delete the original version of the data. You can do this with:

```
# cd /mnt/[location]
# btrfs subvolume create subvol1
# cp -pr --reflink=always dir1 dir2
dir3 subvol1/
# rm -rf dir1 dir2 dir3
```

Systemd issues

I just performed a dist-upgrade to Debian wheezy, which included switching over to systemd for init. After the upgrade, the system stalls out around the time that it's mounting the disks, but before networking is enabled.

I've managed some troubleshooting, including enabling the debug shell, but I can't figure out what's going on. Each of the currently active processes appears to have completed successfully, but it doesn't seem to go on to the next step.

From the debug shell, I cannot run any systemd commands, they just hang until I press Ctrl+C. I'm not using LVM, but I have a software raid mounted on /samba (md0). I can mount all discs manually, but they are not present at the point where systemd stalls.

For reference, here are my kernel arguments:

```
root=UUID=92133eb5-46ac-45b5-acae-
4f044532bbdb ro vga=extended systemd.
log_level=debug systemd.log_target=kmsg
log_buf_len=1M
```

I've been struggling on this for a few weeks and now I'm out of ideas.

Any suggestions are appreciated.

Joe L

From what we understand, the implementation of systemd in Debian testing is still undergoing some bugfixes, but they are usually okay. Of course this doesn't always take into account upgrading from wheezy, which may have caused your problem here.

Above A plumbing layer developer will tell us all about systemd in an upcoming **LU&D** issue

If you can get to some form of command line or just use a live disc, we suggest changing some options in /etc/default/grub, specifically adding a new init= line to the file and maybe checking verbose so that you can see exactly what is happening before it goes wrong.

If all else fails, you might need to do a fresh install of Debian. Here's hoping these systemd issues get fixed as they're causing a bit of distress amongst the community.

Forgetful install

I have a home automation controller on Debian that connects through the serial port on my motherboard. I managed to get it to work just fine but noticed that after every reboot the program wouldn't work again.

The program in question is called BottleRocket and it is available through software manager. I've reinstalled through there, uninstalled and reinstalled through synaptic, and it's always the same outcome: works great, but no dice after reboot. As far as I can tell, the culprit is a link file called

Above Home automation is not always as easy as pressing a button

Firecracker that gets copied to the /dev/ folder. For some reason it always vanishes after a reboot and the commands associated with the program won't work.

Any ideas?

Don Michaelson

Apparently this is something that occurs in Debian every now and then specifically with Firecracker. There is a fix though, and it's very simple, just run this in the terminal:

```
$ sudo echo 'KERNEL=="ttyS0", SYMLINK+="firecracker"' > /etc/udev/rules.d/98-firecracker.rules
```

... followed by a reboot. You should never have to do this step again, but otherwise you may need to try using a different distro for your home automation.

Virtual CPUs

I'm having a struggle with the performance of one of my VirtualBox VMs. I'm running an Asus mobo with an AMD quad-core processor, 1TB hard drive and 16GB of RAM and the VM is Ubuntu running Unity 3D with 10GB of RAM on a 160GB vDisk. I was told the performance issue is probably from using two vCPUs. Specifically that when there's a second vCPU in a VM, the I/O APIC will automatically run and that will slow down I/O calls on the VM, so I should only have one vCPU in my VMs. Is this correct or incorrect?

Cait

> The host and client machines can be very sensitive to these kinds of resources

If you only have one real processor in your system, then trying to get VirtualBox to have multiple vCPUs will not work very well. The host and client machines can be very sensitive to these kinds of resources so any weird imbalance will cause noticeable slowdown. If you do have multiple CPUs though, you can add some or all of them to the virtual machine and it should work. The only problems we've heard of are with Windows XP machines running multiple CPUs but Linux distros should be fine.

Above Be careful when using multiple vCPUs

Hosting listings

Got a deal you think we should list?

Whether you're a hosting firm or a happy customer who wants a favourite provider listed, drop us a line with the details!
linuxuser@imagine-publishing.co.uk

Dedicated server listings

NAME AND URL	PACKAGE	PHONE NUMBER	COST PER MONTH	MINIMUM CONTRACT TERM	CPU CORES / SPEED	DISK SPACE	1GBPS INTERNET CONNECTION	HARDWARE RAID	REMOTE POWER REBOOT	PERMANENT KVM	UPTIME GUARANTEE	NETWORK BACKUP STORAGE	PRIVATE SUBNET	24/7 PHONE SUPPORT
Netcetera www.netcetera.co.uk/linux	2200DC	0800 8085450	£25	1 month	Dual Core 2.2GHz	160GB	N/A	Raid 1	✓	✓	✓	✓	✓	✓
	3000DC	0800 8085450	£40	1 month	Dual Core 3GHz	2 x 250GB	N/A	Raid 1	✓	✓	✓	✓	✓	✓
	2660QC	0800 8085450	£65	1 month	Intel 2.66GHz Quad Core Xeon Processor	2 x 500GB	N/A	Raid 1	✓	✓	✓	✓	✓	✓
	Developer	0800 8085450	£2.99	1 month	N/A	1GB	N/A	✓	✓	✓	✓	✓	✓	✓
	One	0800 8085450	£9.99	1 month	N/A	5GB	N/A	✓	✓	✓	✓	✓	✓	✓
	Reseller	0800 8085450	£24.99	1 month	N/A	Unlimited	N/A	✓	✓	✓	✓	✓	✓	✓
Bravo14 (http://bravo14.co.uk)	Starter Linux	N/A	£20	N/A	N/A	2,000MB	N/A	✓	✓	✓	✓	✗	✓	✓
Bravo14 (http://bravo14.co.uk)	Starter Windows	N/A	£20	N/A	N/A	2,000MB	N/A	✓	✓	✓	✓	✗	✓	✓
Bravo14 (http://bravo14.co.uk)	Business Linux	N/A	£45	N/A	N/A	4,000MB	N/A	✓	✓	✓	✓	✗	✓	✓
Bravo14 (http://bravo14.co.uk)	Business Windows	N/A	£45	N/A	N/A	4,000MB	N/A	✓	✓	✓	✓	✗	✓	✓
Bravo14 (http://bravo14.co.uk)	Ultimate Linux	N/A	£60	N/A	N/A	Unlimited	N/A	✓	✓	✓	✓	✗	✓	✓
Bravo14 (http://bravo14.co.uk)	Ultimate Windows	N/A	£60	N/A	N/A	Unlimited	N/A	✓	✓	✓	✓	✗	✓	✓
catalyst2 (www.catalyst2.com)	Bronze Managed Dedicated Server	0800 107 79 79	£199	1 month	1x 2.4GHz vCPU	50GB	✓	✓	✓	✓	99.90%	✓	✓	✓
catalyst2 (www.catalyst2.com)	Silver Managed Dedicated Server	0800 107 79 79	£299	1 month	1x 2.4GHz vCPU	80GB	✓	✓	✓	✓	99.90%	✓	✓	✓
catalyst2 (www.catalyst2.com)	Gold Managed Dedicated Server	0800 107 79 79	£399	1 month	2x 2.4GHz vCPU	150GB	✓	✓	✓	✓	99.90%	✓	✓	✓
123-Reg (www.123-reg.co.uk)	Dell PowerEdge R200 (Ubuntu Linux)	0871 230 9525	£69.99	12 months	4x 2.13GHz	2x 160GB	10Mbit	✓	✓	✗	99.99%	O	✗	✓
123-Reg (www.123-reg.co.uk)	Dell PowerEdge R200 (Windows Web Edition)	0871 230 9525	£79.99	12 months	4x 2.13GHz	2x 160GB	10Mbit	✓	✓	✗	99.99%	O	✗	✓
Daily (www.daily.co.uk)	Linux VPS Pro	0845 466 2100	£29.99	1 month	2.27 Intel Quad Core	60GB	100Mbps	✓	✓	✗	✗*	✓ - full backup	✗	✗**
Daily (www.daily.co.uk)	Linux VPS Max	0845 466 2100	£59.99	1 month	2.27 Intel Quad Core	100GB	100Mbps	✓	✓	✗	✗*	✓ - full backup	✗	✗**
Daily (www.daily.co.uk)	Windows VPS Pro	0845 466 2100	£34.99	1 month	2.27 Intel Quad Core	60GB	100Mbps	✓	✓	✗	✗*	✓ - full backup	✗	✗**
Daily (www.daily.co.uk)	Windows VPS Max	0845 466 2100	£64.99	1 month	2.27 Intel Quad Core	100GB	100Mbps	✓	✓	✗	✗*	✓ - full backup	✗	✗**
Daily (www.daily.co.uk)	VPS Pro Hyper-V	0845 466 2100	£44.99	1 month	2.27 Intel Quad Core	60GB	100Mbps	✓	✓	✗	✗*	✓ - 1GB	✗	✗**
Daily (www.daily.co.uk)	VPS Max Hyper-V	0845 466 2100	£74.99	1 month	2.27 Intel Quad Core	100GB	100Mbps	✓	✓	✗	✗*	✓ - 1GB	✗	✗**
Daily (www.daily.co.uk)	VPS Ultra Hyper-V	0845 466 2100	£139.99	1 month	2.27 Intel Quad Core	200GB	100Mbps	✓	✓	✗	✗*	✓ - 1GB	✗	✗**
Heart Internet (www.heartinternet.co.uk/dedicated-servers)	Linux Dual Core	0845 644 7750	£79.99	12 months	Dual Core Xeon 2.33GHz	160GB	✓	✓	✓	✗	99.99%	✓	✗	24/7 Ticket support
Heart Internet (www.heartinternet.co.uk/dedicated-servers)	Windows Dual Core	0845 644 7750	£89.99	12 months	Dual Core Xeon 2.33GHz	160GB	✓	✓	✓	✗	99.99%	✓	✗	24/7 Ticket support
Heart Internet (www.heartinternet.co.uk/dedicated-servers)	Linux Quad Core	0845 644 7750	£129.99	12 months	Quad Core Xeon 2.5GHz	250GB	✓	✓	✓	✗	99.99%	✓	✗	24/7 Ticket support
Webfusion (www.webfusion.co.uk)	Dell PowerEdge R210	0845 130 1602	£79.99	12 months	2x 3.06GHz	250GB	Up to 100Mbit	✗	✓	✗	99.99%	Free	O	✓
Webfusion (www.webfusion.co.uk)	Dell PowerEdge R210	0845 130 1602	£119.99	12 months	4x 2.66GHz	2x 250GB	Up to 100Mbit	✓	✓	✗	99.99%	Free	O	✓
Webfusion (www.webfusion.co.uk)	Dell PowerEdge R210	0845 130 1602	£149.99	12 months	4x 2.66GHz	2x 500GB	Up to 100Mbit	✓	✓	✗	99.99%	Free	O	✓

O = Option

GET YOUR LISTING HIGHLIGHTED! CONTACT DANIEL

daniel.gunton@imagine-publishing.co.uk
+44(0)1202 586421

Dedicated and Shared server listings

NAME AND URL	PACKAGE	PHONE NUMBER	COST	WEB SPACE	MONTHLY BANDWIDTH	POP3 ACCOUNTS	DATABASE SUPPORT	SHOPPING CART	VIRUS FILTER	FIREWALL	PHONE SUPPORT	EMAIL SUPPORT	WEB CONTROL PANEL	SERVICE LEVEL AGREEMENT
Blacknight (www.blacknight.com)	Minimus	+44 (0)845 5280242	€49.95	10GB	150GB	1,500	✓	✓	✓	✓	✓	✓	✓	✗
Blacknight (www.blacknight.com)	Medius	+44 (0)845 5280242	€89.95	20GB	300GB	5,000	✓	✓	✓	✓	✓	✓	✓	✗
Blacknight (www.blacknight.com)	Maximus	+44 (0)845 5280242	€149.95	30GB	600GB	Unlimited	✓	✓	✓	✓	✓	✓	✓	✗
Digital Gibbon Ltd (www.digitalgibbon.com)	Cheeky Chimp	N/A	Free	500MB	Unlimited	5	✓	✗	✓	✓	✗	✓	✓	✗
Digital Gibbon Ltd (www.digitalgibbon.com)	Digital Gibbon	N/A	£12	5GB	Unlimited	10	✓	✗	✓	✓	✗	✓	✓	✗
Digital Gibbon Ltd (www.digitalgibbon.com)	Silverback	N/A	£24	Unlimited	Unlimited	Unlimited	✓	✓	✓	✓	✗	✓	✓	✗
Digital Gibbon Ltd (www.digitalgibbon.com)	WordPress hosting	N/A	£12	5GB	Unlimited	10	✓	✗	✓	✓	✗	✓	✓	✗
eHosting (www.ehosting.com)	Starter	0844 999 4100	£23.88	1GB	25GB	10	✗	✗	✗	✗	✗	✓	✓	✓
eHosting (www.ehosting.com)	Personal	0844 999 4100	£59.88	2.5GB	Unlimited	50	✓	✗	✗	✗	✗	✓	✓	✓
eHosting (www.ehosting.com)	Expert	0844 999 4100	£95.88	5GB	Unlimited	250	✓	✗	✗	✗	✗	✓	✓	✓
eHosting (www.ehosting.com)	Virtual	0844 999 4100	£227.88	50GB	Unlimited	Unlimited	✓	✗	✗	✗	✓	✓	✓	✓
Equiphase (www.equiphase.net)	Bronze	0121 314 4865	£30	200MB	2GB	10	✓	✓	✗	✓	✗	✓	✓	✓
Equiphase (www.equiphase.net)	Silver	0121 314 4865	£42	400MB	5GB	20	✓	✓	✗	✓	✗	✓	✓	✓
Equiphase (www.equiphase.net)	Gold	0121 314 4865	£72	800MB	10GB	100	✓	✓	✗	✓	✗	✓	✓	✓
Equiphase (www.equiphase.net)	Platinum	0121 314 4865	£114	1,200MB	40GB	200	✓	✓	✓	✓	✓	✓	✓	✓
Eurofasthost.com (www.eurofasthost.com)	Email Only	02380 249 823	£40	1GB	2GB	10	✗	✗	✓	✓	✓	✓	✓	✓
Eurofasthost.com (www.eurofasthost.com)	Essential	02380 249 823	£75	2GB	5GB	10	✗	✗	✓	✓	✓	✓	✓	✓
Eurofasthost.com (www.eurofasthost.com)	Superior	02380 249 823	£140	5GB	10GB	25	✓	✓	✓	✓	✓	✓	✓	✓
Eurofasthost.com (www.eurofasthost.com)	Premium	02380 249 823	£250	10GB	25GB	100	✓	✓	✓	✓	✓	✓	✓	✓
Evohosting (www.evohosting.co.uk)	Starter	N/A	£29.99	500MB	1GB	3	✓	✓	✓	✓	✗	✓	✓	✓
Evohosting (www.evohosting.co.uk)	Home	N/A	£54.99	2.5GB	30GB	50	✓	✓	✓	✓	✗	✓	✓	✓
Evohosting (www.evohosting.co.uk)	Business	N/A	£79.99	6.5GB	Unlimited	Unlimited	✓	✓	✓	✓	✗	✓	✓	✓
Evohosting (www.evohosting.co.uk)	eCommerce	N/A	£159.99	30GB	Unlimited	Unlimited	✓	✓	✓	✓	✗	✓	✓	✓
Giacom (www.giacom.com)	Business Pro	0800 542 7500	£199	100MB	2GB	100	✓	✓	✓	✓	✓	✓	✓	✓
Heart Internet (www.heartinternet.co.uk)	Starter Professional	0845 644 7750	£29.80	2.5GB	10GB	1,000	✗	✗	✗	✓	✗	✓	✓	✓
Heart Internet (www.heartinternet.co.uk)	Home Professional	0845 644 7750	£89.99	10GB	50GB	10,000	✓	✓	✗	✓	✗	✓	✓	✓
Heart Internet (www.heartinternet.co.uk)	Business Professional	0845 644 7750	£129.99	Unlimited	Unlimited	Unlimited	✓	✓	✗	✓	✗	✓	✓	✓
Heart Internet (www.heartinternet.co.uk)	Reseller Professional	0845 644 7750	£299.99	Unlimited	Unlimited	Unlimited	✓	✓	✗	✓	✗	✓	✓	✓
Hostway (www.hostway.co.uk)	Silver	0808 180 1880	£79.50	150MB	3GB	5	✗	O	✓	✓	✗	✓	✓	✗
NameHog (www.namehog.net)	Email Only	0845 612 0330	£11.75	25MB	1GB	5	✗	✗	✓	✓	✓	✓	✓	✓
NameHog (www.namehog.net)	Standard Package	0845 612 0330	£35.25	100MB	4.5GB	10	✗	✗	✓	✓	✓	✓	✓	✓
NameHog (www.namehog.net)	Professional Package	0845 612 0330	£58.75	250MB	8GB	25	✓	✓	✓	✓	✓	✓	✓	✓
NameHog (www.namehog.net)	Expert Package	0845 612 0330	£105.75	500MB	15GB	75	✓	✓	✓	✓	✓	✓	✓	✓
Skymarket (www.skymarket.co.uk)	Standard 1	0800 321 7788	£49	10MB	2GB	1	✓	✗	✓	✓	✓	✓	✓	✓
Skymarket (www.skymarket.co.uk)	Standard 2	0800 321 7788	£69	20MB	2GB	1	✓	✗	✓	✓	✓	✓	✓	✓
Skymarket (www.skymarket.co.uk)	Premium 1	0800 321 7788	£99	25MB	2GB	1	✓	✗	✓	✓	✓	✓	✓	✓
ServWise (https://www.servwise.com)	Personal	0800 520 0716	£25.20	1GB	10GB	Unlimited	✓	✓	✓	✓	✓	✓	✓	✓
ServWise (https://www.servwise.com)	Business	0800 520 0716	£50.40	2GB	20GB	Unlimited	✓	✓	✓	✓	✓	✓	✓	✓
ServWise (https://www.servwise.com)	Reseller	0800 520 0716	£126	4GB	40GB	Unlimited	✓	✓	✓	✓	✓	✓	✓	✓
WebFusion (www.webfusion.co.uk)	Fusion Professional	0845 130 1602	£107.40	5GB	50GB	1,000	✓	✗	✓	✓	✓	✓	✓	✗
WebFusion (www.webfusion.co.uk)	Fusion Business	0845 130 1602	£179.40	10GB	150GB	1,500	✓	✗	✓	✓	✓	✓	✓	✗
WebFusion (www.webfusion.co.uk)	Fusion Developer	0845 130 1602	£227.40	20GB	300GB	5,000	✓	✗	✓	✓	✓	✓	✓	✗
WebFusion (www.webfusion.co.uk)	Fusion Reseller	0845 130 1602	£329.99	Unlimited	Unlimited	Unlimited	✓	✗	✓	✓	✓	✓	✓	✗

O = Option

YOUR VIEW

Linux User Letters

Your opinions about the magazine, Linux and open source

Bitter Chromebooks

I read Simon Brew's article on tablets in schools a couple of issues ago and I've had a similar experience with changing technology in schools. My son's school is using Chromebooks and I've seen a number of seminars and other items indicating [that] this is becoming common. Some schools are even switching out iPads.

They're cheaper. When they lose or break the Chromebook, just grab another. Leaving it at home/school is [essentially the same] as losing them for a short time to the IT department as well. Data is shared if needed and if they don't have a Chromebook, anything running Chrome can be used.

Plus the admin tools are better so there is less work for the IT department and, more importantly, the teachers and parents.

Tom Buskey

Changing the way kids learn on computers is necessary because of the ever-changing landscape of computing in general. The use of Chrome, Chrome OS and Chromebooks in this way seems like a very happy medium compared to jumping straight onto tablets that essentially remove a large element of computing from the equation.

We don't see a tablets-only future at the moment so switching completely to iPads seems like a bad idea for multiple reasons.

Systemd of a down

I have some very serious doubts about systemd. I feel it is taking over Linux and giving users less control over the lower levels of their system. I also have issues with some of the bugs it keeps getting, which can cause system-wide issues, and the potential security risks it creates. I really haven't seen much talk about it in your magazine, though. Where do you stand on the issue? Should we go back to the way it was with individual processes?

Jake

Systemd is a very touchy subject for a lot of people. We've seen some fairly hyperbolic headlines literally saying that systemd is the harbinger of the apocalypse. Whether it's satire or not doesn't really matter as there are plenty of users who genuinely think along these lines. To some they are the vocal minority, something the internet trades a lot in. Others believe it's equal amounts of positive and negative, whereas a silent majority is staying out of it.

Our opinion? It's early days. It's slowly being put into more and more systems and there will be a lot more development before it becomes a Linux 'standard'. We hope it doesn't cause problems, but it may make things easier for some people and that would be excellent.

Android Magazine

With more and more Android features being merged back into the Linux Kernel, it's becoming much easier to develop for one of the most popular mobile operating systems around. With over 25 billion app downloads, and over 100 million Android devices worldwide, there's a wide audience of folks ready and willing to consume apps. For a more Android-driven editorial, you can look to our sister mag **Android Magazine**, the only publication dedicated to the platform. Along with news and reviews to keep you up-to-date on everything Android, there are also tutorials and advice on developing and hacking your hardware. Find out more at www.littlegreenrobot.co.uk.

Left Chromeboxes and Chromebooks come in many shapes and sizes but are all simple and relatively cheap

Linux User & Developer
THE MAGAZINE FOR THE GNU GENERATION

THREAD BARE

What? Sysadmin is evolving!

When we announced the Linux Foundation's plans for a new certification course we also added one of the Foundation's infographic with the different 'stages' of a sysadmin illustrated with Penguins. The definitions surprised and delighted some on reddit. Find out your level at: http://bit.ly/1rM5Xv3.

bobarob said:
See I could count myself as a novice or junior, but I know how devices and device drivers work. I've modified some myself. It's hard to classify sometimes.

ChojinDSL said:
Yeah, I have trouble classifiying myself as well. I'd probably be somewhere between Junior and Senior myself. Gave me a chuckle though.

POTUS said:
This is normal. The more you know, the more you know you don't know. It might feel like you shouldn't call yourself a senior level sysadmin because you're sure they can come up with something you don't know or don't do well enough, but at the end of the day you just have to realise that nobody knows everything. Being able to make use of the resources available to you to make things work is what really makes a senior sysadmin.

ydna_eissua said:
Look at the recent Matthew Garrett AMA. He mentioned numerous areas he feels he knows nothing about.

sigma914 said:
O.o, apparently I'm a senior... that seriously can't be all [there] is to it.

BlueDragonX said:
I guess once you start contributing code to the kernel you're no longer a sysadmin.

interbutt said:
I would call that an engineer

CandyCorns_ said:
Seems like some of these distinctions are really blurry, because I consider myself having aspects of Novice, Junior, Intermediate/Advanced, and Senior.

But, I'm not a sysadmin, just a guy that's used Linux for many years.

demizer said:
I'm actually employed as a Junior Linux System Admin. I would say this is accurate, but there is much more to being a Senior Admin.

Imagine Publishing Ltd
Richmond House, 33 Richmond Hill
Bournemouth, Dorset, BH2 6EZ
☎ +44 (0) 1202 586200
Web: www.imagine-publishing.co.uk
www.linuxuser.co.uk
www.greatdigitalmags.com

Magazine team

Deputy Editor Gavin Thomas
gavin.thomas@imagine-publishing.co.uk
☎ 01202 586257
Production Editor Carrie Mok
Designer Sam Ribbits
Senior Staff Writer Rob Zwetsloot
Photographer James Sheppard
Senior Art Editor Will Shum
Editor in Chief Nick Roberts
Publishing Director Aaron Asadi
Head of Design Ross Andrews

Contributors
Joey Bernard, Gareth Halfacree, Tam Hanna, Richard Hillesley, Jon Masters, Aaron Shaw, Richard Smedley, Nitish Tiwari, Mihalis Tsoukalos, Leo White.

Advertising
Digital or printed media packs are available on request.
Head of Sales Hang Deretz
☎ 01202 586442
hang.deretz@imagine-publishing.co.uk
Advertising Manager Alex Carnegie
☎ 01202 586430
alex.carnegie@imagine-publishing.co.uk
Account Manager Daniel Gunton
☎ 01202 586421
daniel.gunton@imagine-publishing.co.uk

FileSilo.co.uk
Assets and resource files for this magazine can now be found on this website.
Support filesilohelp@imagine-publishing.co.uk

International
Linux User & Developer is available for licensing.
Head of International Licensing Cathy Blackman
☎ +44 (0) 1202 586401
licensing@imagine-publishing.co.uk

Subscriptions
For all subscriptions enquiries
☎ 0844 249 0282 (UK)
☎ +44 (0) 1795 418661 (Overseas)
Email: LUD@servicehelpline.co.uk
6 issue subscription (UK) – £25.15
13 issue subscription (Europe) – £70 (ROW) - £80

Circulation
Head of Circulation Darren Pearce
☎ 01202 586200

Production
Production Director Jane Hawkins
☎ 01202 586200

Founders
Group Managing Director Damian Butt
Group Finance & Commercial Director Steven Boyd

Printing & Distribution
Printed by William Gibbons, 26 Planetary Road, Willenhall, West Midlands, WV13 3XT

Distributed in the UK, Eire & the Rest of the World by:
Marketforce, Blue Fin Building, 110 Southwark Street
London, SE1 0SU
☎ 0203 148 3300
www.marketforce.co.uk

Distributed in Australia by:
Network Services (a division of Bauer Media Group)
Level 21 Civic Tower, 66-68 Goulburn Street
Sydney, New South Wales 2000, Australia
☎ +61 2 8667 5288

ISSN 2041-3270

FileSilo

YOUR FREE RESOURCES

LOG IN TO **WWW.FILESILO.CO.UK/LINUXUSER-145** AND DOWNLOAD THE LATEST DISTROS AND FREE SOFTWARE TODAY

ALL THE DISTROS, FOSS AND CODE THAT YOU NEED TO FOLLOW THE MAGAZINE

LATEST DISTROS

TUTORIAL CODE

THIS ISSUE'S PACKAGES TO DOWNLOAD: **+1GB**

TOP LINUX FOSS

YOUR BONUS RESOURCES

ON FILESILO THIS ISSUE, FREE AND EXCLUSIVE FOR LINUX USER & DEVELOPER READERS, YOU'LL FIND THESE GREAT RESOURCES...

- 20 Essential FOSS packages, including: MRTG, RRDtool, Vagrant & SonarQube
- 3 Best Ubuntu flavours: Ubuntu, Kubuntu and Lubuntu
- Code and assets for all tutorials, including the BigTrak Rocket Launcher attachment
- Distro Directory: Quick links to download the very best Linux distros

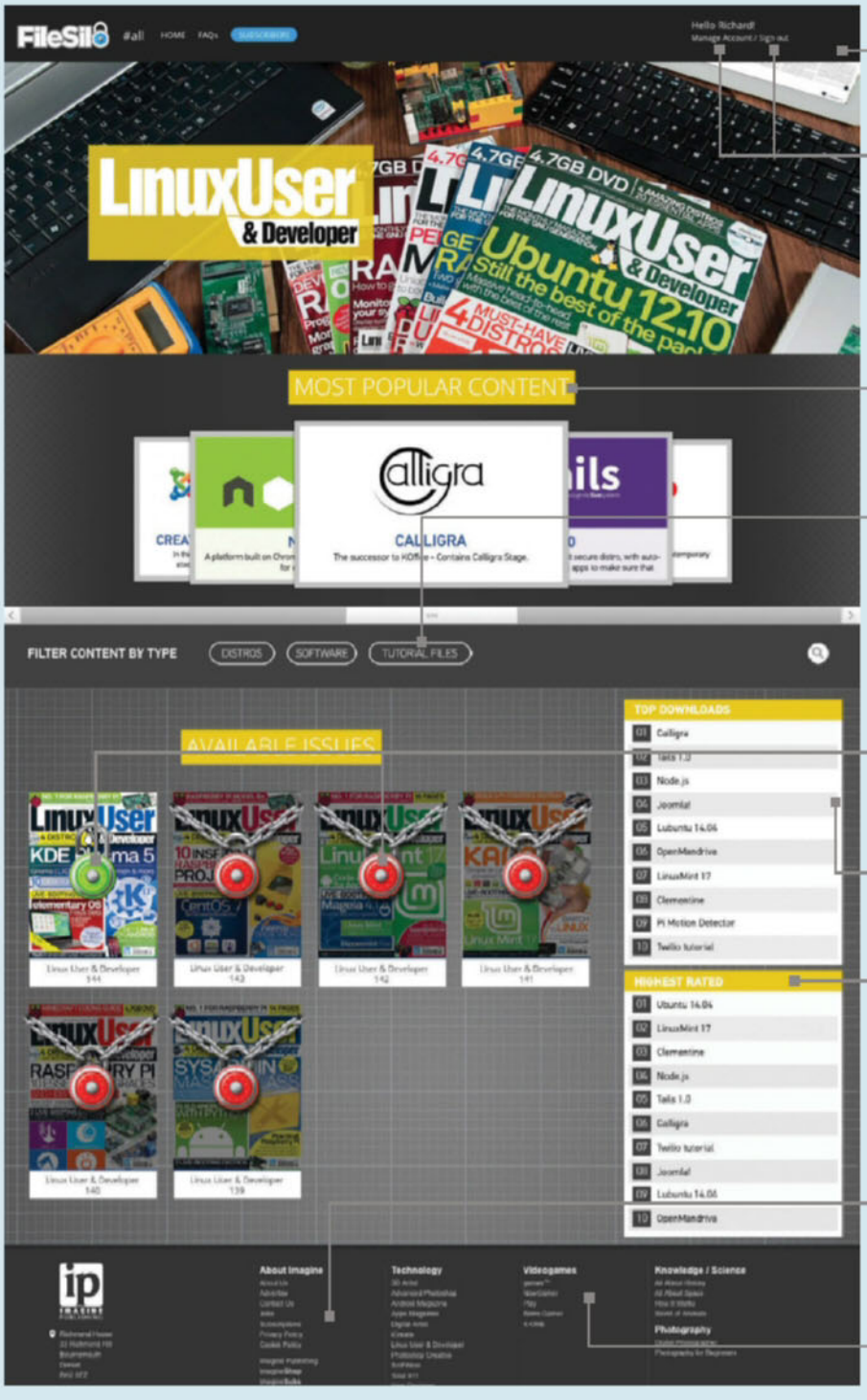
FileSilo

www.filesilo.co.uk/linuxuser-145

FILESILO – THE HOME OF PRO RESOURCES

DISCOVER YOUR FREE ONLINE ASSETS

- A rapidly growing library
- Updated continually with cool resources
- Lets you keep your downloads organised
- Browse and access your content from anywhere
- No more torn disc pages to ruin your magazines
- No more broken discs
- Print subscribers get all the content
- Digital magazine owners get all the content too!
- Each issue's content is free with your magazine
- Secure online access to your free resources



This is the new FileSilo site that replaces your disc. You'll find it by visiting the link on the following page.

The first time you use FileSilo you'll need to register. After that, you can use the email address and password you provided to log in.

The most popular downloads are shown in this carousel, so see what your fellow readers are enjoying!

If you're looking for a particular type of content like brushes or fonts, use the filters here to refine your search.

Green open padlocks show the issues you have accessed. Red closed padlocks show the ones you need to buy or unlock.

Top Downloads are listed here, so you can get an instant look at the most popular downloaded content.

Check out the Highest Rated list to see the resources that other readers have voted for as the best!

Find out more about our online stores, and useful FAQs like our cookie and privacy policies and contact details.

Discover our amazing sister magazines and the wealth of content and information that they provide.

HOW TO USE

EVERYTHING YOU NEED TO KNOW ABOUT ACCESSING YOUR NEW DIGITAL REPOSITORY

To access FileSilo, please visit www.filesilo.co.uk/linuxuser-145

01 Follow the instructions on-screen to create an account with our secure FileSilo system, or log in and unlock the issue by answering a simple question about the magazine. You can access the content for free with your issue.

02 If you're a print subscriber, you can easily unlock all the content by entering your unique Subscriber ID. You can find this on all correspondence from Imagine Publishing, including the clear plastic envelopes your magazine gets delivered to your door in every month.

03 You can access FileSilo on any desktop, tablet or smartphone device using any popular browser (such as Safari, Firefox or Chrome). However, we recommend that you use a desktop to download content, as you may not be able to download files to your phone or tablet.

04 If you have any problems with accessing content on FileSilo, or with the registration process, take a look at the FAQs online or email **filesilohelp@imagine-publishing.co.uk**

MORE TUTORIALS AND INSPIRATION

Finished reading this issue? There's plenty more free and open source goodness waiting for you on the Linux User & Developer website. Features, tutorials, reviews, opinion pieces and the best open source news are uploaded on a daily basis, covering Linux kernel development, the hottest new distros and FOSS, Raspberry Pi projects and interviews, programming guides and more. Join our burgeoning community of Linux users and developers and discover new Linux tools today.

www.linuxuser.co.uk

Issue 146 of LinuxUser & Developer is on sale 20 Nov 2014 from GreatDigitalMags.com

FRESH. FAST. FREE.

LIBRE.

The Document Foundation
proudly presents:

LibreOffice

the world's most advanced free software office suite

www.libreoffice.org

poundhost
A NAMESCO COMPANY

24/7 UK SUPPORT

Dedicated Servers

intel SSD

NEW DC

33% OFF

Quote Voucher code:
PHLUD33

- No Contracts
- 24/7 OnSite Support
- Dell Hardware
- Varied Server Range

From
£19 per month

Dedicated Servers | Cloud Servers | VPS | Domains | Email | Hosting | SiteMaker | Ecommerce | Servers | SSL | Site Promotion

Dada Figures and Stats:

490,000	8,000	6,000	1,800,000
Number of Customers	Number of Dedicated Servers	Number of Virtual Servers (VPS)	Number of Domains

tel: **0800 876 0942**
www.poundhost.com

poundhost
A NAMESCO COMPANY