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First Steps

You've been hearing about Linux for years. Your Linux friends have told you all about it – how you don't have to pay for it and you don't have to pay for the thousands of applications that go with it: word processors, spreadsheets, photo editors, music players, and more. You've heard about the built-in security features and the natural protections against malware. You've heard about the vibrant and colorful Linux community – the millions of users around the world united in the desire to build, test, perfect, and document the ever-evolving Linux environment.

Early versions of Linux were hacker tools for geeks who liked to compile their own software, but those days have been over for years. Linux today offers a full-featured graphic user experience, much like Windows or Mac OS. The interface might seem unfamiliar at first, but once you get used to it, you will learn that Linux is actually quite logical and easy to use.

This special edition will help you take your first steps with Linux. Because Linux is available to everyone, many different vendors and organizations support their own Linux *distributions*. A distribution consists of the core Linux operating system, plus a collection of accompanying applications, libraries, and other components. The differences between the different distributions are not so significant for experienced users, but if you're just getting started and you're looking for a place to point and click, it helps to focus on a single version.

This special edition features the openSUSE Linux distribution. OpenSUSE is the free community edition based on SUSE Linux. SUSE, began in 1992 as the first company devoted to providing services around Linux. (The Linux kernel was created in 1991, so SUSE is nearly as old as Linux itself!) SUSE Linux, which dates back to 1994 is one of the oldest Linux distros, and it has a reputation for enterprise-ready professional stability and performance. The DVD attached to this issue has everything you'll need to install openSUSE.

The first few articles in the *Get Started* section assume you're using openSUSE. If you prefer a different version of Linux, and you already have it up and running, you might want to skip the *Get Started* section and move on to later articles, which focus on applications like Gimp, Wine, and OpenOffice that are common to all Linux flavors.

If you're fed up with paying for software, or if you're just curious about what Linux is and how it works, read on for a special guided tour. Welcome to the world of Linux!

Joe

Joe Casad,
Editor in Chief

Getting Started with Linux

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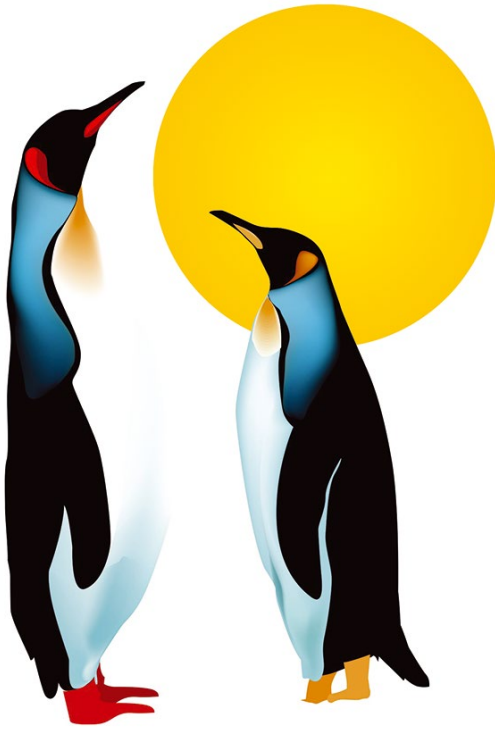
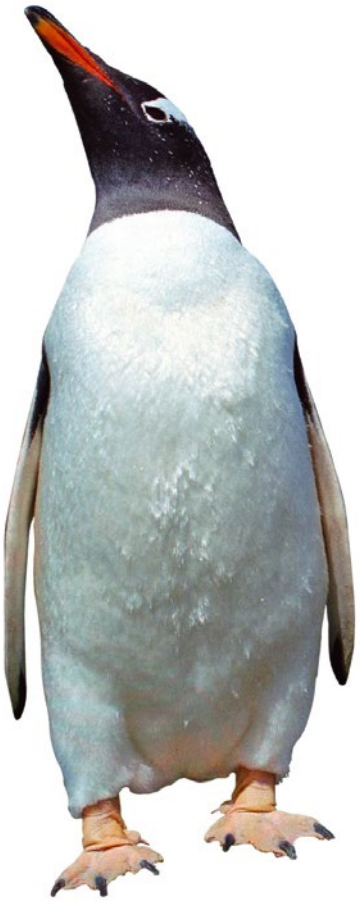
Welcome to Getting Started with Linux, a single-volume bookazine with all you need to install and explore the powerful Linux operating system.



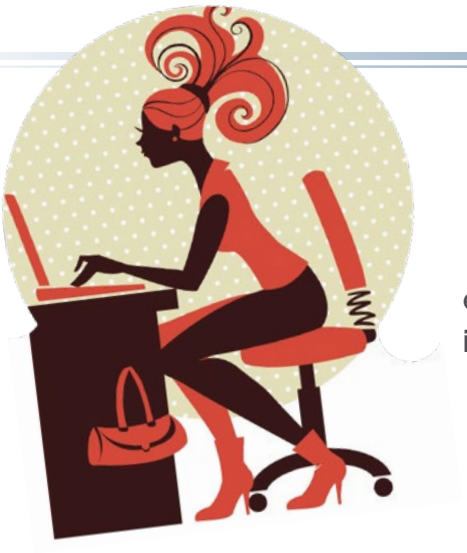
26 Plasma Desktop: Take your first look at openSUSE and the KDE Plasma desktop.

32 Linux Crash Course: Learn about file permissions and the powerful command-line interface.



Get Started

Service



In-Depth

Desktop

Gaming

openSUSE Leap 15

All the software you need to get started with Linux!

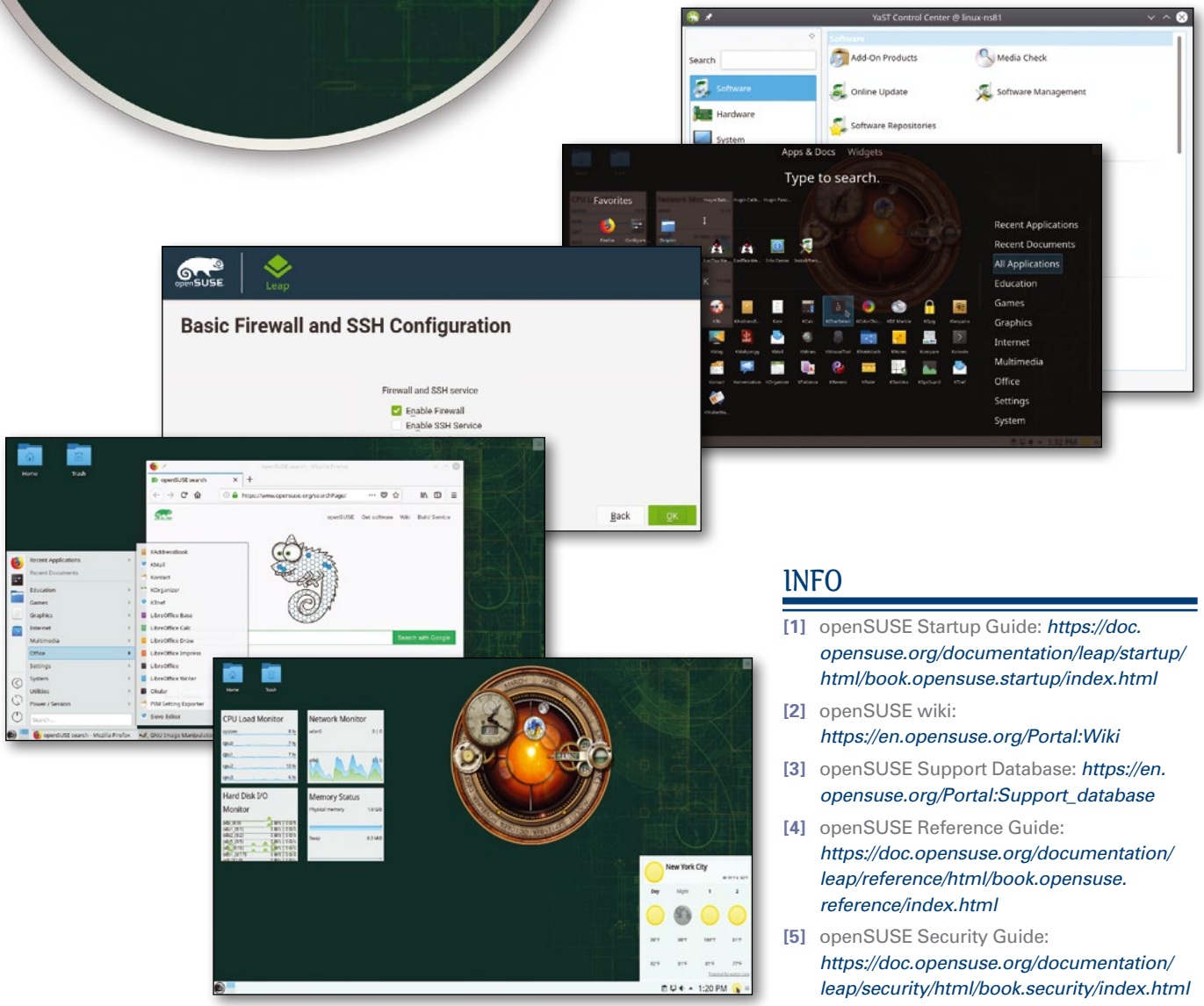
See page 6 for details

On the DVD

openSUSE Leap 15

The DVD attached to this issue comes with openSUSE Leap 15. OpenSUSE is the community edition based on the enterprise-ready SUSE Linux. Leap comes pre-packaged with hundreds of powerful applications for everyday tasks, as well as professional programming tools and web-ready network services. Just put this DVD in the DVD drive and restart your system. An easy installer will take you through the steps of setting up openSUSE.

See the article on page 8 for more on installing openSUSE Leap.



Info

[1] openSUSE Startup Guide: *https://doc.opensuse.org/documentation/leap/startup/html/book.opensuse.startup/index.html*

[2] openSUSE wiki: *https://en.opensuse.org/Portal:Wiki*

[3] openSUSE Support Database: *https://en.opensuse.org/Portal:Support_database*

[4] openSUSE Reference Guide: *https://doc.opensuse.org/documentation/leap/reference/html/book.opensuse.reference/index.html*

[5] openSUSE Security Guide: *https://doc.opensuse.org/documentation/leap/security/html/book.security/index.html*

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Sharing a Windows computer with openSUSE Linux

Ready, Set, ...

Linux comes with a good reputation for security, stability, and a vast abundance of free, enterprise-ready software. Experts recommend Linux, because it's resistant to viruses, malware, and spyware, and it is very simple to install. *By Sven Seeberg-Elverfeldt and Markus Feilner*

Linux was once considered a system for hackers and experts, but times have changed. Today's Linux is every bit as easy on the beginner as Windows or Mac OS, and the best part is, it is all free. The operating system is free, and thousands of tools are also free and are available for installation with only a couple of mouse clicks.

The new Linux is simple and very accessible for the beginner. Once you get started, you'll appreciate the ease of use, the security, and the freedom you get with a Linux system. As your knowledge of Linux expands, your system will evolve with you. When you're ready to reach beyond a simple desktop environment, just add the necessary tools, and your system can easily act as a web server, file server, software development system, and much more.

Lead Image © Jon Will, 123RF.com

This special edition will help you take your first steps with Linux. The Linux version included as a DVD with this issue is openSUSE Leap 15. OpenSUSE is a community-based project sponsored by SUSE, one of the oldest and most respected Linux companies. The installation and configuration steps described in this issue are based on openSUSE Leap. If you are using a different Linux distribution, some of the steps will differ, but the concepts are similar. The tools described in later articles, such as Firefox, LibreOffice, and Gimp, will work on any Linux system.

Distributions

Linux comes in *distributions*. A distribution (or "distro") is a collection of applications, utilities, components, and drivers, combined with the Linux kernel and a constellation of background services, to provide a complete operating environment. Unlike Windows and Mac OS, which are rigidly defined by the companies that control them, Linux has an open source license that makes it easy to combine it with a custom set of applications and adapt it for different purposes. Companies, nonprofit organizations, and even some individuals, maintain their own Linux distros, each with slightly different goals and slightly different approaches. Linux distros are designed to work on servers, desktop systems, mobile devices, and even embedded devices.

OpenSUSE Leap [1] is a general-purpose distro that is simple enough for beginners but contains advanced packages that will allow you to adapt it to developer and server room scenarios. A new edition of Leap appears approximately ever 12 months. Much of the software in openSUSE Leap comes from SUSE Linux Enterprise (SLE) [2], an enterprise distro oriented to the needs of large companies (see Table 1). Leap provides over 10,000 packages that are

completely open source and are installed with a few mouse clicks.

Repeal or Replace?

OpenSUSE can be installed next to Windows or replace it. When installed next to Windows, a prompt (the Linux "boot manager") will ask which operating system to boot each time the computer powers up. This dual-boot setup allows for the continued use of Windows while allowing you to familiarize yourself with Linux.

Repositories

While the Microsoft Store or even the Android Play Store are relatively new, Linux distributions have long used online, centralized application installation sources, which have been around since the 1990s (and even longer for Unix, an antecedent of Linux). These centralized installation sources for program packages are very convenient for users, storing many readily available packages that have been tested and created by reliable sources – in this case, the openSUSE community and SUSE. Programs are generally available at your fingertips from official sources, along with additional third-party sources (so-called repositories) that can be added for other, newer or fancier programs.

All packages on the source servers are kept up to date. Installing updates for a Linux-based operating system then means automatically updating all installed programs. Available updates are usually shown on the desktop and can be installed with a few clicks. Always having the latest versions of all installed programs is the single most important factor in the security of your system.

To ensure that only valid packages are installed, all openSUSE packages come with a cryptographic signature that can be verified by the local software management program. This reduces the risk of downloading manipulated software by accident and adds another layer of security when compared with manually searching and downloading software from unknown file hosts. OpenSUSE also provides the user with a friendly configuration tool called YaST to manage software.

In contrast to Windows, which provides only a single graphical user interface (GUI), Linux offers more variants. Although some versions still boot into text-based interfaces, more commonly you boot into a GUI, generally called a desktop environment. The most common desktop environments are KDE and Gnome. Both provide plenty of features, add-ons, and customization opportunities.

TABLE 1: Family Ties

Name	Entity
openSUSE	The open source project (including Leap, Open Build Service, websites, and a lot of software)
Leap	An openSUSE distribution, with a classic development model that is published about every 12 months
Tumbleweed	The openSUSE "rolling release" of continuously developed and tested cutting edge technology
SUSE	The company offering SUSE Linux Enterprise
SUSE Linux Enterprise (SLE)	The enterprise distribution and its ecosystem (e.g., cloud, storage) developed by SUSE, who offers services and support and cooperates tightly with openSUSE.

By default, openSUSE Leap 15 installs programs that cover many daily tasks. LibreOffice is the default office suite with the capability of creating text documents, spreadsheets, presentations, and more. Gimp, Hugin, and digiKam together provide a powerful set of programs for image manipulation and management. Firefox, KMail, and Kopete make up a set of programs for tasks like web surfing, emailing, and instant messaging.

Drivers in Linux

In contrast to other operating systems, most Linux distributions come with hardware drivers already installed. You do not need any extra CDs, DVDs, or downloads: Drivers are part of the Linux kernel, the core of the Linux operating system. Therefore, newer kernel versions provide drivers for more recent hardware – once developers have created them.

Some drivers, like those for printers, are not part of the Linux kernel, but belong to a program called CUPS for printing and SANE for scanning. Most printers will be detected and integrated upon installation.

Preparing the Installation

Hardware requirements for Linux, in general, are very modest, but this largely depends on the software that you want to run. Modern GUIs like KDE and Gnome require a current computer with standard hardware. Desktop environments with lower hardware expectations, like Xfce and LXQt, are better suited for older computers. For KDE or Gnome, at least 2GB of RAM and more than 15GB of storage on a hard disk are recommended.

If you have important data on the computer on which openSUSE is installed, we highly recommend you create a backup first, which should be stored on an external data medium like a USB drive, DVD, or network storage. Operating system installation programs usually allow you to modify the partitions on

hard disks. Accidentally selecting the wrong drive and removing partitions can lead to data loss; thus you need to make sure the backup is not within reach of the installer during installation.

Starting the Installation

This issue comes with the openSUSE Leap 15 installation DVD. To install Leap from the DVD, place the disc in your computer's DVD player and restart. Be sure your system is configured to boot from the DVD drive. (See the vendor documentation for your computer for more on how to access the setup menu and configure DVD boot.)

You can also install the openSUSE Leap ISO image to a USB drive. (See the box entitled "Creating a Bootable Medium.") If you are booting from a USB drive, plug the drive into your computer. Most computers will automatically try to start from USB devices. If not, you'll have to manually select the USB drive from the temporary boot menu (often accessible via F12) or through your setup menu, which is accessed in various ways, depending on the age and make of your computer.

Once the openSUSE installation disk boots, it displays a menu with several options. *Boot from Hard Disk* will boot an already installed operating system, such as an established Windows installation or openSUSE if the USB drive is present after the installation is finished. The openSUSE installation starts when *Installation* is selected. Navigate with the Up and Down arrow keys and press Enter to activate an option. As soon as the openSUSE installer starts, it prompts for your keyboard layout and language selection before partitioning the disk.

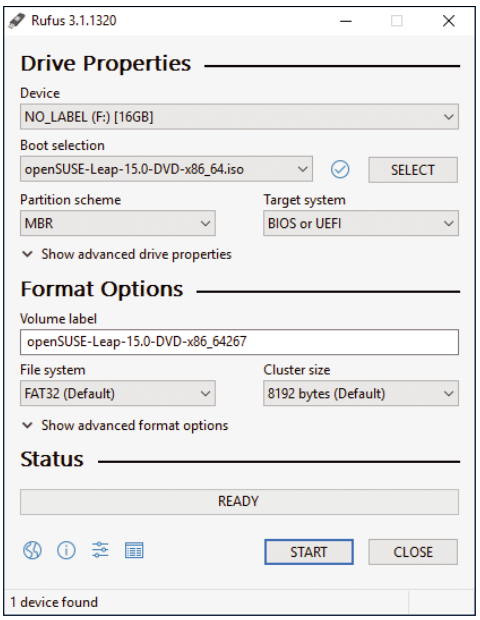


Figure 1: Rufus can be used to create bootable USB drives from ISO images.

Hard Disk Partitioning

In Windows, hard disk partitions are assigned letters with a colon. The first drive, which usually also contains the Windows installation, is called `C:`, the next one `D:`, and so on. While partitions also exist in Linux, they are not named by letters. The term "drive" usually refers to the physical hard disk or similar media. Partitions under Linux are mounted into directories. Instead of `C:`, you will always have a root directory (`/`) that contains the complete operating system with all subdirectories. One of those subdirectories is `/home`, which contains the user's personal documents and settings. Commonly, Linux distributions use a different partition for the user's home directory; clicking on *Edit Proposal Settings* and selecting *Encrypted LVM-based Proposal* will automatically encrypt your home directory for greater data security.

Hard drives and their partitions are addressed as pseudo-files in the `/dev` directory. The first disk in the system is `/dev/sda`, the second disk `/dev/sdb`, and so on. Partitions are addressed with numbers in the path names. For example, the first partition on the first disk is `/dev/sda1` and the second partition `/dev/sda2`. If Linux is the only operating system, the partition `/dev/sda2` is mounted as the root filesystem under `/`.

Partitioning for Experts

The openSUSE installer automatically proposes to create two partitions: one for the root directory and one for home. A third partition is proposed as a swap partition (a space in which to shift inactive memory when RAM is low). If Windows is already installed on the computer, the installer proposes to reduce the size of the Windows partition and install openSUSE in the now free space. It is usually safe to accept the proposal.

To modify the partition table manually, you can click on *Expert Partitioner* and then select the correct hard disk (in most cases `sda`); resizing the partition layout is an easy task (Figure 2). The root partition should be larger than 10GB, and the home partition can be sized to personal requirements but should have at least a couple of gigabytes.

After partitioning, you select the time zone. This can either be done by clicking on the map or by selecting a Region and Time

Creating a Bootable Medium

Before you can begin installation, you'll need a bootable USB drive. The open source Rufus Windows program [3] (Figure 1) creates a bootable USB drive from an downloadable image file (usually a DVD/CD ISO image file). The current openSUSE Leap 15 installation ISO DVD image is available on the openSUSE website [1].

As soon as the `.iso` file download finishes, you can select the ISO with the CD icon button to the right of the line *Create a bootable disk using*. After you select the ISO image, the setting will automatically change to *DD Image*. In the uppermost dropdown menu, you must select a plugged in USB drive. All data currently residing on the USB drive will be deleted, but it can be used later as a normal USB drive again. Clicking the *Start* button creates a bootable drive. This process usually takes a couple of minutes.

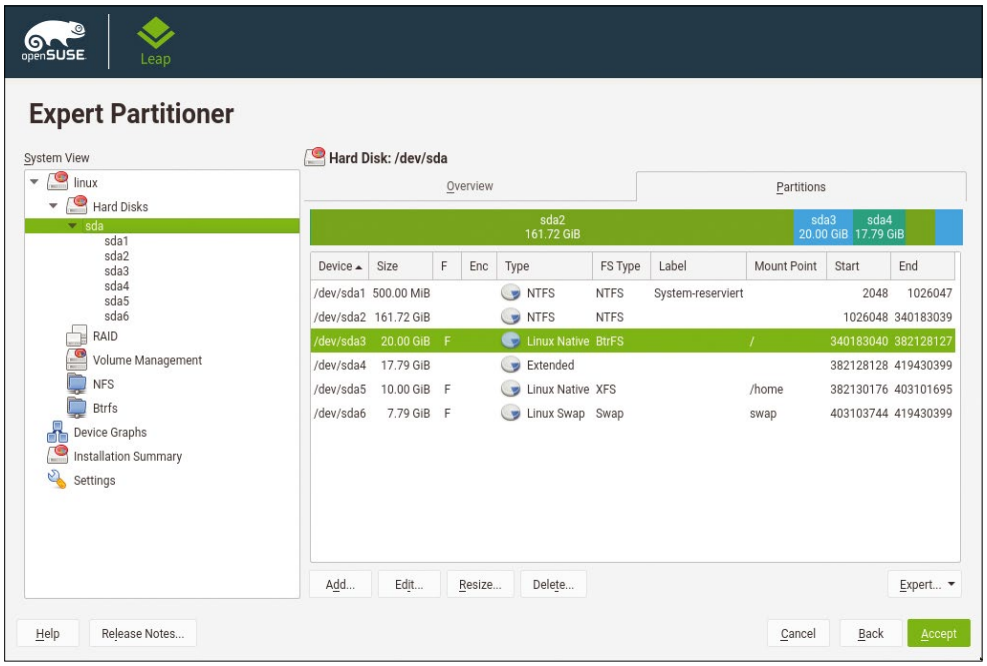


Figure 2: The Expert Partitioner shows the partition layout for Windows and openSUSE installed on a single hard disk.

Zone from the corresponding drop-down menus (Figure 3).

Choosing the Look and Feel

The next step lets the user choose their preferred interface. The GUI provides access to installed programs and is responsible for creating, decorating, and managing windows on the screen. The position of buttons, available key combinations, and the usability with a mouse has a large influence on your workflow. Having different desktop environments at hand is one of the most powerful features of open source and Linux: It allows you to choose the perfect fit for your personal requirements.

By default, openSUSE 15 installs the KDE desktop environment. KDE has a look and feel that is somewhat similar to Windows. It comes with a Start menu in the lower left corner listing the installed applications, is highly configurable, and has a pleasant look. The alternative, Gnome, has a very distinct look and feel and provides fewer configuration options by default – which might keep you from getting lost in configuration panels. Its main goal is ease of use and a polished user interface.

Creating a Login and Final Check

After you select a GUI, you need to create a login. The installer asks for a username and a password. By default, this password is also used for the system administrator, who always has the username *root*. Only root is allowed to install new programs or apply changes to the system. Therefore, you will need the password frequently. In contrast to other operating systems, Linux emphasizes the difference between normal users and the root user. The automatic login option provides additional convenience if only one or only trusted persons have physical access to the computer.

The last step before installation starts is checking the Installation Settings page, which contains a summary of all the configuration choices you've made or allowed to default. Although you can change settings by clicking on

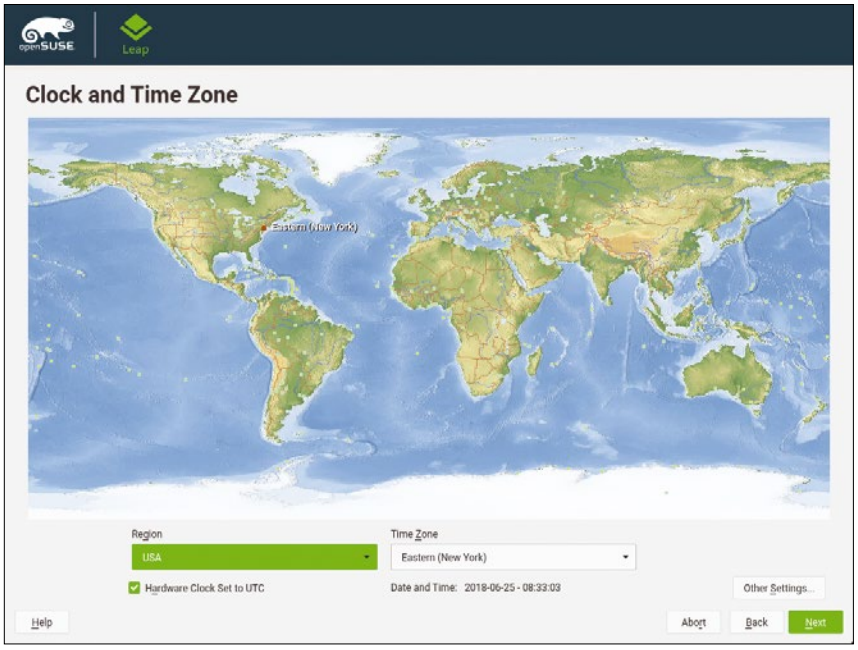


Figure 3: Selecting a time zone during the installation.

an item, this is usually not required, because if something needs to be changed, it can be done later with the YaST configuration tool (see the article on YaST elsewhere in this special edition). The installation starts with a click on the *Next* button and usually only takes a couple of minutes. As soon as the setup is finished, the computer restarts.

First Boot

Before openSUSE starts, its bootloader offers to boot other operating systems or restore snapshot backups of the Linux filesystem. Each time openSUSE installs or updates programs, snapshots are automatically created and added to the boot manager. In case something goes wrong, booting from a snapshot is the easiest way to restore the previous state. If automatic login is enabled, the system will start KDE automatically; otherwise, a graphical login screen is presented.

Using KDE

After logging in, the KDE desktop environment starts (Figure 4). Along the bottom is the main panel, and to the left side of the main panel is the main menu, which provides access to all installed programs, system settings, and reboot and shutdown buttons. The menu can be opened by either clicking the chameleon icon or by pressing the Windows logo key on the keyboard. In the Linux world, the Windows logo key is often referred to as the Super key.

The left side of the start menu has shortcut buttons to the Firefox web browser, the desktop configuration, and the Dolphin file browser. The search field can be used to search for program names, tasks, or files.

Next to the Start menu is the icon for multiple desktop workspaces. This is one of the most notable differences between most Linux desktop environments and other operating systems. Each desktop can have its own set of arranged windows. For example, multiple desktops allow you to group application windows by activities. One desktop can be used for writing an article and doing research, and another desktop can be used for chatting and mailing. To switch between desktops, you use the Ctrl + F1 and Ctrl + F2 key combinations.

Connecting to the Internet

On the right side of the main panel, clock, battery, network, and other icons display the computers' status at a glance. The tiny NetworkManager icon can be used to connect to a WiFi network, access VPNs (if the suitable client software is installed), or change network settings.

If the computer has a working Ethernet network connection and a DHCP router in reach, the network will be configured automatically. Wireless adapters usually work without any further configuration, and a wireless network can be selected by clicking the network symbol in the main panel.

Summary

OpenSUSE makes it easy to get a Linux system up and running and ready to put to constructive use. You can install openSUSE onto a hard drive by itself or share a drive (dual boot) with another operating system, such as Windows. Whichever way you decide to install, openSUSE delivers a stable, secure, and easy-to-use Linux desktop. ■

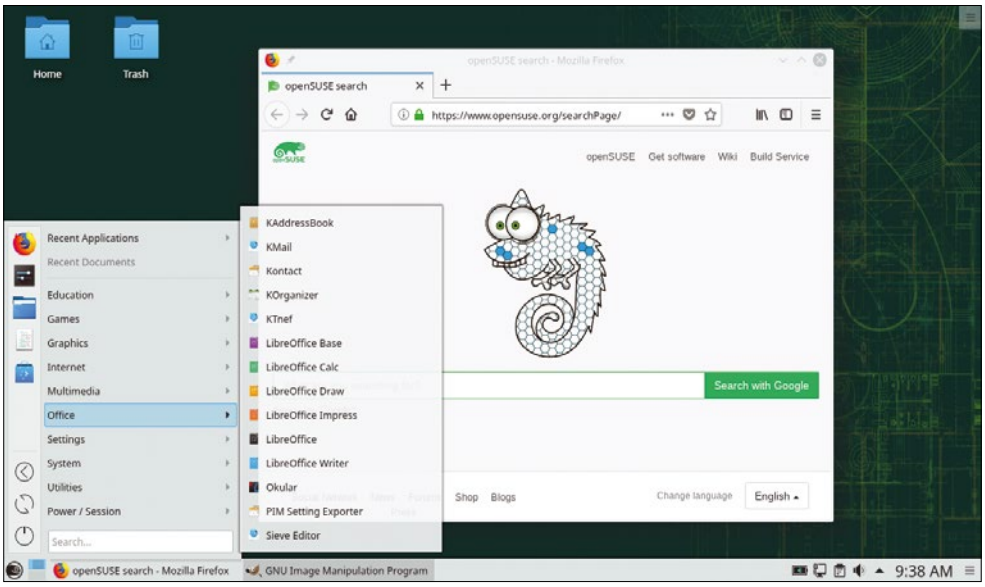


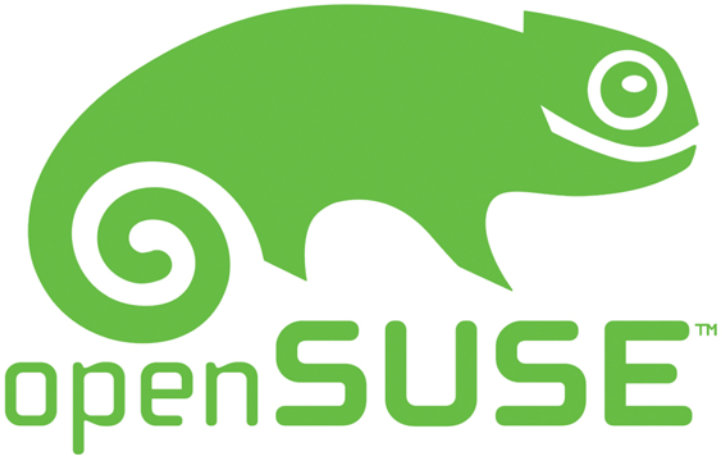
Figure 4: The KDE Desktop with Firefox and the Application menu.

Info

[1] openSUSE: *https://opensuse.org*

[2] SUSE: *https://www.suse.com*

[3] Rufus: *https://rufus.akeo.ie*



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YaST: An omnibus tool

All Things Considered

YaST functions as your openSUSE system's control center; it lets you perform several configuration tasks, from installing software and adding new users, to setting up complex services – all in a single interface. *By Imobach González Sosa, Ancor González Sosa, Lukas Ocilka, Gilson Souza, Martin Vidner, Rodion Iafarov, and Ladislav Slezak*

Once you've installed openSUSE Leap, you can start browsing the web, writing documents, or organizing your picture collection. At some point, you'll also need to install new applications, print documents, or share some files with other computers within your network. That's where YaST comes into the picture.

In this article, we introduce you to YaST and show you how to configure your system to fit your specific needs with a minimum of effort. At the same time, experts are safe to directly access configuration files; YaST will not overwrite or make manual changes unless told to do so.

Getting to Know YaST

To launch YaST, choose *System* | *YaST* in the system menu. Enter the system administrator's root password when prompted, and you should see the YaST Control Center in the left pane (Figure 1). The Control Center provides quick access to most of the installed YaST functions. These functions are sorted by categories, giving you a good overview of all the available YaST modules.

The right pane gives you access to all YaST modules. To locate a specific module, use the list of categories in the left pane, or start typing the module's name into the search box. For example, enter *update*, and the list of sections and modules will be narrowed to the matching modules.

When working in the configuration and installation dialogs initiated by YaST, you can use the *Help* button to get further information about a specific module or term. Moreover, don't worry about breaking your system: You can always undo any choices by pressing the *Cancel* button before accepting your changes.

The nice thing about YaST is that you can use it even without a graphical desktop environment. In addition to the slick graphical interface, YaST features a text-based version that is useful in many situations (Figure 2).

Configuring the Network

On modern Linux systems, network settings commonly configure themselves automatically on first connection. However, life is not always that easy, so YaST features a powerful tool that allows you to adjust several aspects of your network configuration, if necessary. Before going any deeper, it's important to note that YaST can rely on two

different services to manage the network: NetworkManager and Wicked.

NetworkManager handles dynamic configurations quite well, so it is used by default when you are running a laptop. Wicked is used in any other case. This distinction is important, because if you are using NetworkManager, YaST will only be able to set a few parameters (mostly hostname and DNS servers). After all, NetworkManager is well integrated with most desktop environments, so you should use its specific tools. On the other hand, Wicked is SUSE's specific replacement of the old way of configuring networking while retaining backward compatibility.

To take a closer look at network configuration, click on *System* | *Network Settings* in the YaST Control Center. The configuration options are organized in four tabs: *Global Options* allows you to select which service should be used (NetworkManager or Wicked) among other general options; *Overview* lets you configure each network interface (IP address, persistent names, etc.); *Hostname/DNS* offers a mechanism to adjust anything that has to do with domain name resolution; and finally, *Routing* lets you set advanced routing rules.

As you can see, the YaST network configuration module is quite powerful, allowing you to set up complex network scenarios. Take your time exploring the different options to get a better idea of how it works.

Software Management

As one of its best features, openSUSE offers a lot of software for you to enjoy. Default installation includes web browsers, an office suite, multimedia applications, and games, as well as some powerful image manipulation programs to make your vacation pictures look better.

However, imagine you want to add an artistic touch to some of those pictures. In that case, you might be interested in Krita, a painting program. If you want to install Krita, or any software for that matter, the *Software Management* module is your best friend.

In the openSUSE world, software is distributed in so-called packages. In a nutshell, maintainers take care of packaging an application into a format that allows you to install and update the software easily. It might sound simple, but is not: Maintainers also keep the packages up to date, apply patches wherever needed, test the software, and so on.

To install Krita, open the YaST Control Center and click on *Software* | *Software Management*. YaST loads package information (it might take a few seconds) and displays an interface for managing packages. Enter *krita* in the text box located next to the *Search* button and press Enter (or click the button). YaST searches for any package containing *krita* in its name, related keywords, or summary and displays the results on the right side. Select the *krita* package and press *Accept*. YaST might ask you to install some additional packages that are needed or recommended (i.e., dependencies), which are handled automatically. After you accept the summary of changes, packages will be downloaded and installed. Now, you can open Krita and become an artist for a while.

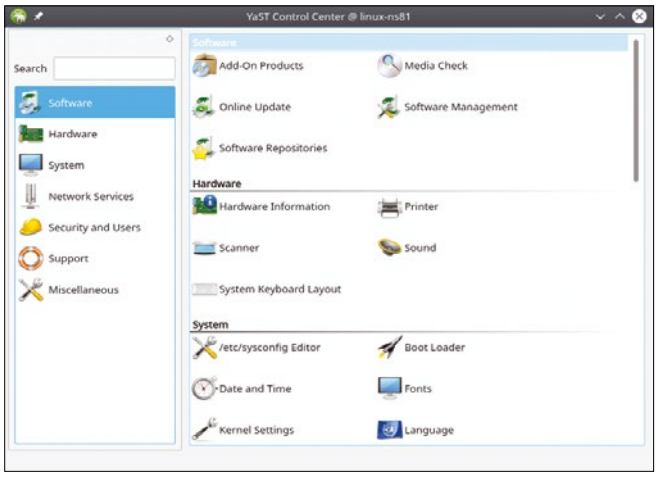


Figure 1: YaST features a graphical interface ...

Software patterns are another interesting openSUSE software management concept. Simply put, a pattern brings several related packages together. For instance, say you want to set up a web server. To do this, you need to install several specific services and tools. Instead of installing them one by one, you just install the pattern *Web Server*, and the packaging system will take care of installing everything you need.

Here is another example: Most users have a favorite desktop environment (and some users prefer no desktop environment at all) and stick to it for quite some time. However, Linux is about choice, and trying new things is fun. So what if you want to give another desktop environment, like Xfce, a try? Instead of selecting individual packages, you only need to install the pattern *XFCE Desktop Environment*.

The YaST software manager interface

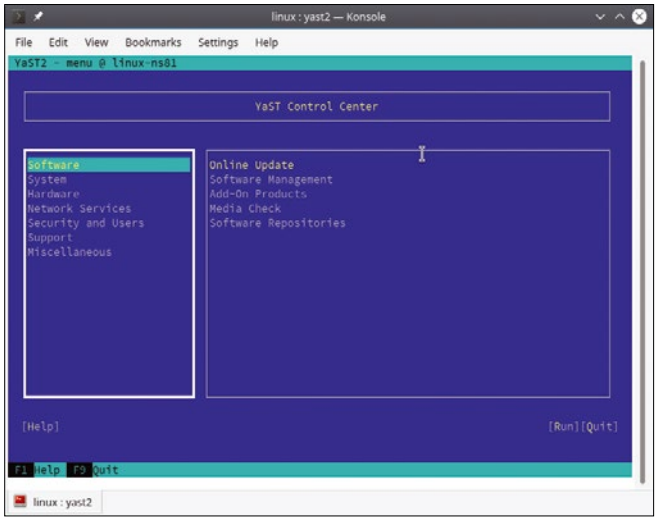


Figure 2: ... and a text-based interface.

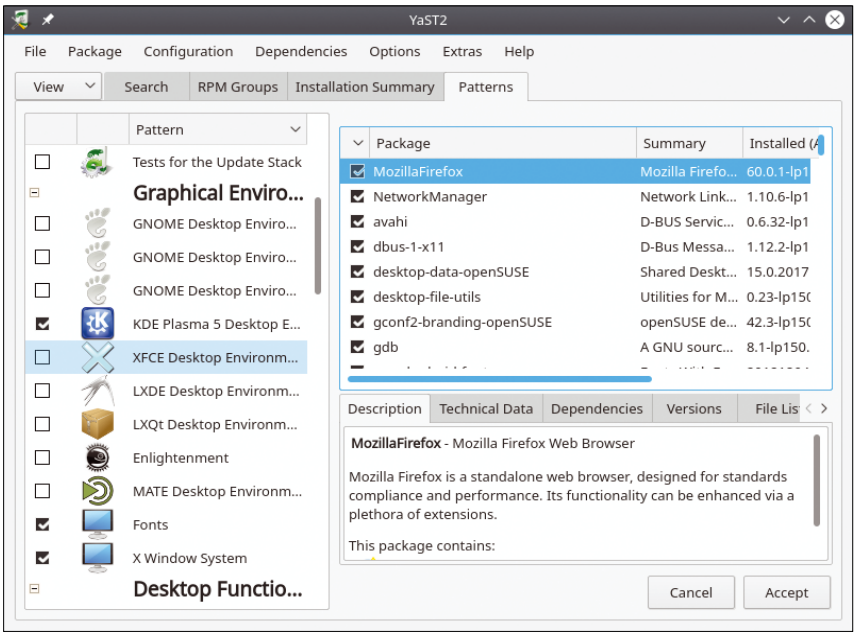


Figure 3: Browsing software patterns.

features different views depending on which task you want to perform. Unfold the *Views* selector at top left and choose the *Patterns* view. Now patterns are listed on the left side. If you click on any of them, you will see a list of related packages to the right. Select the pattern you want to install (in this case, *XFCE Desktop Environment*) and related packages will be selected (Figure 3). This time, before clicking *Accept*, you might want to check the *Installation Summary* tab for the complete list of changes. Finally, press *Accept*, and YaST starts the installation. To give Xfce a try, log out and log in again (selecting Xfce in the login screen).

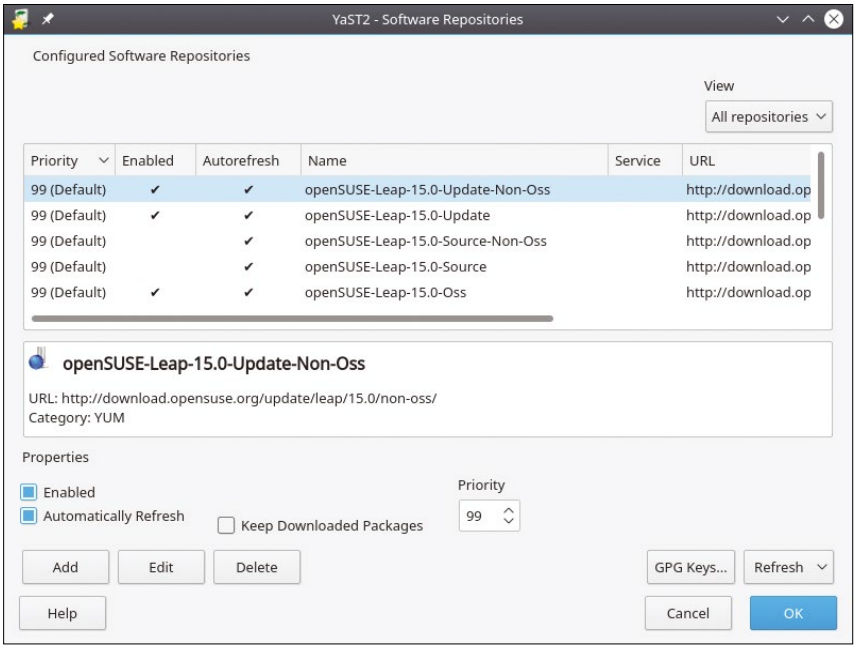


Figure 4: Overview of software repositories.

Uninstalling software is equally easy: Find the packages you want to uninstall, unselect them, and click *Accept*. Sometimes, removing a certain package can remove other related packages, too. Fortunately, YaST warns you about this, and you can always abort the action by pressing *Cancel*.

Software Repositories

So far, you have been playing with the software manager and have installed some additional applications, so you may be wondering where that software originates. Packages are organized and indexed in package repositories. The DVD (or the USB stick) with the image you used to install your system contains a repository with a subset of openSUSE packages. The official repositories located on the openSUSE mirrors contain much more software waiting to be installed.

You can add those repositories when installing openSUSE, or you can add them afterward. Additionally, the openSUSE project provides repositories containing software that is not included by default in the distribution, like some drivers and codecs.

You can add those repositories to your system using *Software | Software Repositories* (Figure 4). Press the *Add* button and select the *Community Repositories* option. YaST downloads and shows a list of available repositories. Select the one you want to add (if any) and press *OK*.

Now, the software from that repository should be available for installation in the *Software Management* module. Before you start this module, though, you should close *Software Repositories*, because both modules will lock the packaging system in order to avoid interference when they are dealing with packages, repositories, and so on. No worries, though: YaST warns you in such a scenario.

As you may have noticed, adding community repositories is only one of the many options that the repositories management module offers. For instance, you may be interested in adding a custom repository by specifying the URL. When adding custom repositories, make sure that they are compatible with your installed system (openSUSE Leap 15), because adding incompatible repositories can result in dependency errors or other serious issues. Moreover, you should also check the repository's license as some repositories might provide commercial, non-free, or patented software.

Last, but not least, bear in mind that some community repositories and all custom third-party repositories are not maintained by the

openSUSE project. Adding an unknown repository poses a potential security risk, so only add the repositories you trust, and do not forget to verify GPG signature keys.

Configuring Printers

YaST not only helps you handle software, but it also detects and configures hardware connected to your machine. Although many paper documents now happily live in digital form, printers still remain a staple of many offices and homes. If you happen to have a printer connected to your computer, YaST can help with configuration.

Before setting up the printer, connect it to the computer and turn it on to give YaST a chance to auto-detect. In the YaST Control Center, navigate to *Hardware* | *Printer* (Figure 5). After reading the current configuration, YaST will show a list of configured printers. Press *Add*, and you should see a dialog to specify your brand new printer configuration. The dialog is split in two parts: the connection settings at the top and the driver settings at the bottom.

The connection settings are used to specify where to find the printer. Is it connected through a USB port? Or is it accessible through the network? Maybe it's a Bluetooth device? In the best case, YaST will present a list of detected devices, so you only have to pick one. If your printer is not automatically detected, you will have a chance to find it with the Connection Wizard (see below).

In the driver settings section, you need to choose which driver should be used with the selected printer. If your printer was automatically detected, the list of drivers will be narrowed to those that are compatible. Select the one that best matches your printer (if it does not work as expected, you can change it later).

After setting the connection and the driver to use, select the default paper size and press *OK*. That's all, but before declaring a victory, you should check whether the printer is working as expected. In the list of configured printers, select the one you have just added and click *Print Test Page*. If something went wrong, press *Edit* and review your settings.

If your printer is not detected automatically, YaST has you covered. With the Connection Wizard, you will be able to set up your printing details. Click *Add* in the list of printers (or when editing an existing printer) and then use the *Connection Wizard* button (at top right of the connection settings section). This wizard lets you select the connection mechanism and fills in the details. For example, say you want to use a shared printer on a Microsoft Windows system. On the left, select *Print via Print Server Machine* | *Windows (R) or Samba (SMB/CIFS)*. On the right, specify server settings (server and printer name at least); when you are done, press the *Test Connection* button. Did it work? If so, then just press *OK* and finish your printer configuration (selecting the proper driver). If it did not work, you will need to review your settings again. Once everything works, the driver should be available, and you can start printing.

Sharing is Caring

If you want to share files or printers with others on your local network, with Windows machines, or with both, your best option is to use Samba. It allows you to share files and printers with Linux, Windows, and Mac OS machines, as well as Android devices. YaST helps set up sharing, too.

Go to the YaST Control Center and click on *Network Services* | *Samba Server*. After the program loads, a dialog asking for your "Workgroup or Domain Name" opens. If your local network already has a domain name or workgroup, you'll simply enter its name here; otherwise, you can create an appropriate name for your workgroup. This same name should be used later in the configuration of other machines on your local network.

Click *Next* and a new dialog asks for the Samba Server type. If you are not a network administrator, you may leave the option *Not a Domain Controller* checked and click *Next*. Check the option *Open Port in Firewall*, so you will be able to share your data and printers on your local network. Here, you can also choose how the service starts. If you prefer to keep the file and printer shares when you start your machine, enable the *During boot* option. Otherwise, enable the *Manually* option to share files only when necessary.

Choose the *Shares* tab and verify the configuration in the *Available Shares* section. To

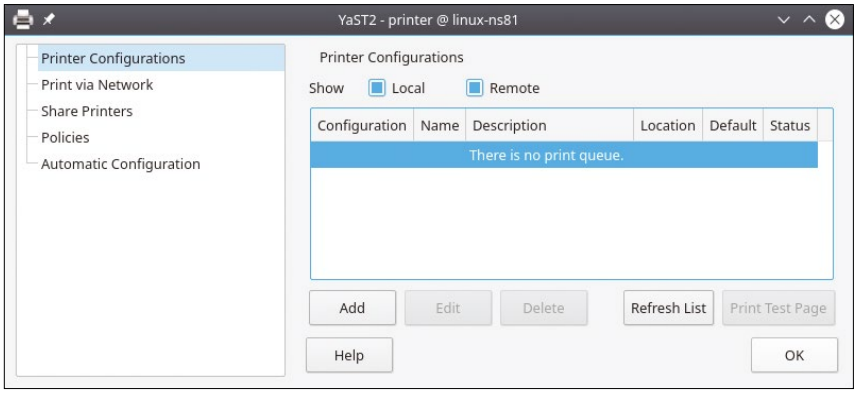


Figure 5: YaST has a printer module for configuring CUPS, the standard Linux printing system.

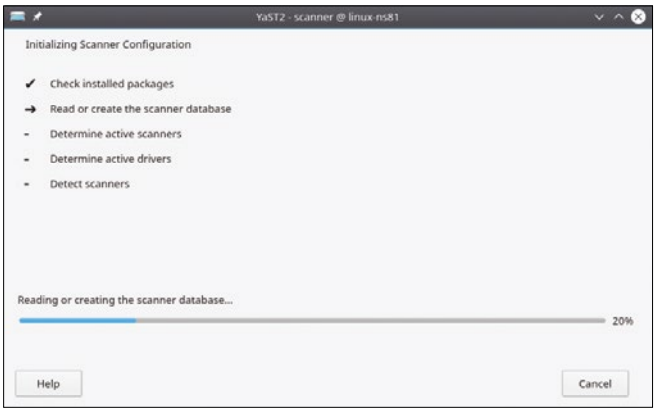


Figure 6: YaST's SANE module prepares to search for scanners on USB or other ports.

share the printers, make sure the Status column is set to *Enabled* for the *All Printers* and *Printer Drives* options. If you want to share a directory different from the ones currently on the list, click *Add*, write a name and a short description for this shared directory, and click *Browse* to select the directory to share. Choose *Read Only* if you do not want to allow others to write to this directory and then click *OK*. Once you have finished with all parts of the configuration, click *OK* in the Samba Server window, and YaST will apply the configuration to the system.

The shared files can be accessed on a Windows machine in exactly the same way as other shares on Windows machines on the network. They can also be accessed on a Linux machine by configuring Linux with the same Workgroup or Domain Name in the YaST *Samba Server* module and then using one of the Linux file browsers, such as Gnome Files [1] or Dolphin [2].

Scanners

To configure your scanner, click *Hardware | Scanner* in the YaST Control Center. YaST will try to find the available scanners (Figure 6) and display a list of detected devices. If your scanner is not on the list (e.g., because it's not connected), you can add it manually using the *Add* button at the bottom. When you are done, press *OK*, and your scanner should be ready to use. How do you use the scanner on openSUSE? You can use the `scanimage` program from the command line (included with SANE [3]) or, even better, install a graphical front end to make your life easier. (You could give the venerable Xsane [4] a try). Other applications, like LibreOffice.org, Gimp, and Krita, have built-in support for scanning documents, too.

Checking System Logs

Sometimes things can go wrong, and when they do, you need a tool to find the root cause of the problem. A lot of relevant information about system operations is stored in system logs, including messages from the kernel, services, applications, and other sources.

Nowadays, most Linux distributions rely on a rather complex program called systemd to manage and store system logfiles (so-called journals), but some applications handle logs differently by storing them in `/var/log`. YaST offers a convenient way to browse both sources of information, and you can find those tools in the YaST Control Center's *Miscellaneous* section. Whereas *System Log* is a simple browser for those logs stored under `/var/log`, *Systemd Journal* (Figure 7) relies on the systemd logging system and features filtering capabilities, making it easy to find the pertinent information.

If you want to search for specific information, the text box at the top of the window lets you narrow down the list. For instance, typing *RAM* will reduce the list of entries to those containing that word.

Conclusions

YaST offers a single, unified interface for configuring and managing your openSUSE Linux system.

This article described basic YaST functionality, including sharing your files, configuring your printer, and installing or removing programs from your system. However, these are just a small fraction of YaST's capabilities. For example, you can use YaST to improve your system's security, show your programs' status, help network administrators to configure different types of servers, and much more. ■

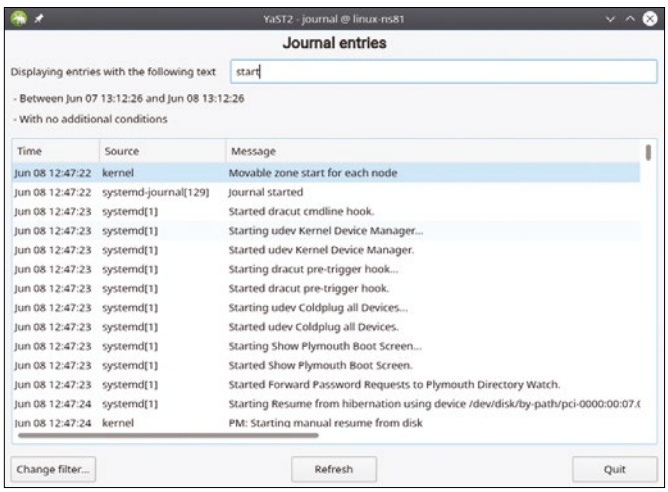


Figure 7: You can set filters to look for relevant information.

INFO

[1] Gnome Files: *https://en.opensuse.org/GNOME_Files*

[2] Dolphin: *https://userbase.kde.org/Dolphin*

[3] SANE: *http://www.sane-project.org/*

[4] Xsane: *https://linux.die.net/man/1/xsane*

Keeping your system secure in openSUSE Leap

Safe, Safer, Linux

Linux has a good reputation, and for a good reason. From firewalls to advanced security tools like AppArmor and SELinux, there's a YaST module for almost everything. *By Markus Feilner*

What? No viruses on Linux? Once you've become a Linux user, you'll have to prepare yourself for questions like these. It's true. Only five proof-of-concept Linux viruses exist, but there are many more funny jokes about how a working Linux virus would look, including having a user manually copy and execute it, then kindly send it on to all his friends, and ask them to run and redistribute it, as well. Standard viruses don't work on Linux for a variety of reasons, so you don't have to worry about antivirus software and similar tools well known in the Windows world. In this article, I show where you find the relevant nuts and bolts in openSUSE Leap that define how securely your system is set up.

Why is Linux so secure? One reason, of course, is that Linux is not as widespread on the desktop as Windows or Mac OS, but it does dominate large segments of the server market, which would make it a great target. (See the box titled "What Is Security?") However, since its origins more than 25 years ago, no hacker has successfully created a Linux virus, partly because it handles user privileges and separation of processes better, but also because of the nature of Linux: It comes in a lot of varieties, so a virus would need to infiltrate many different platforms. Apart from that, the open source model gives developers better chances to fix bugs and glitches in their software – and hopefully faster than Microsoft or Apple can.

WHAT IS SECURITY?

An old saying states that "security is the good feeling an admin has when going home at night," and that's not far from wrong. No matter what marketing tells you, nothing to do with IT systems is 100% secure.

Security is not a binary quality (secure-insecure); in fact, it ranges along a scale from "secure enough" to "not secure enough." Costs rise exponentially the closer you get to secure enough; thus, everybody – enterprise, home user, IT pro, or hacker – has to decide the level of security they are willing to pay for, apply, and follow.

Which attacks do you want to protect yourself from? How much damage can be done? Even before Snowden's revelations, we knew it was difficult or impossible to protect standard IT systems against government attacks. Experts call this an "overqualified attack." Protection against automated and scripted attacks by commercial villains or script kiddies, though, makes sense and is easily reached by exchanging as many Windows systems with Linux systems as possible.

Like most modern Linux systems, openSUSE Leap is a good choice for secure desktops, workstations, and home servers. The default settings will give you a safe working environment that is considered by many experts to be much safer than proprietary systems.

THE AUTHOR

Markus Feilner is a seasoned Linux expert from Regensburg, Germany. He has been working with free and open source software since 1994 as a trainer, consultant, author, and journalist. He is currently employed as Team Lead of the SUSE Documentation Team in Nuremberg, Germany.

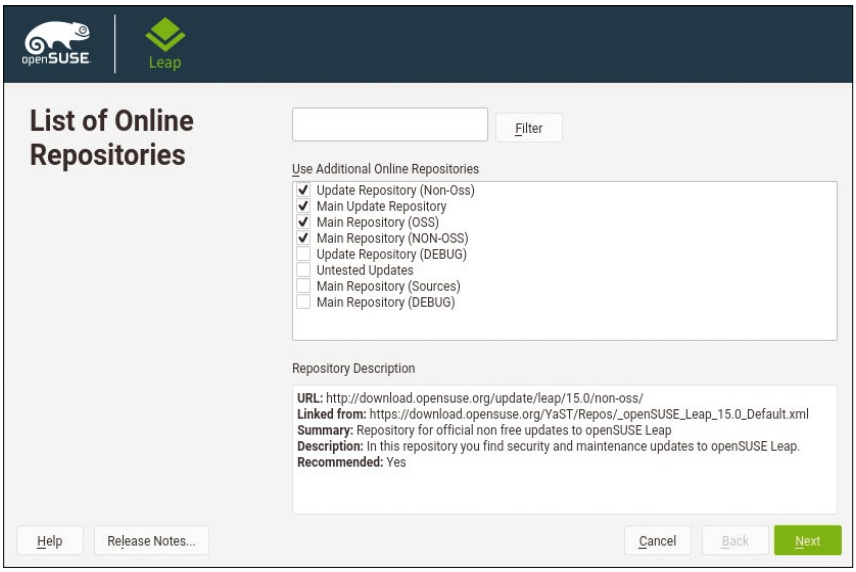


Figure 1: The checked boxes show the default online repositories to be activated.

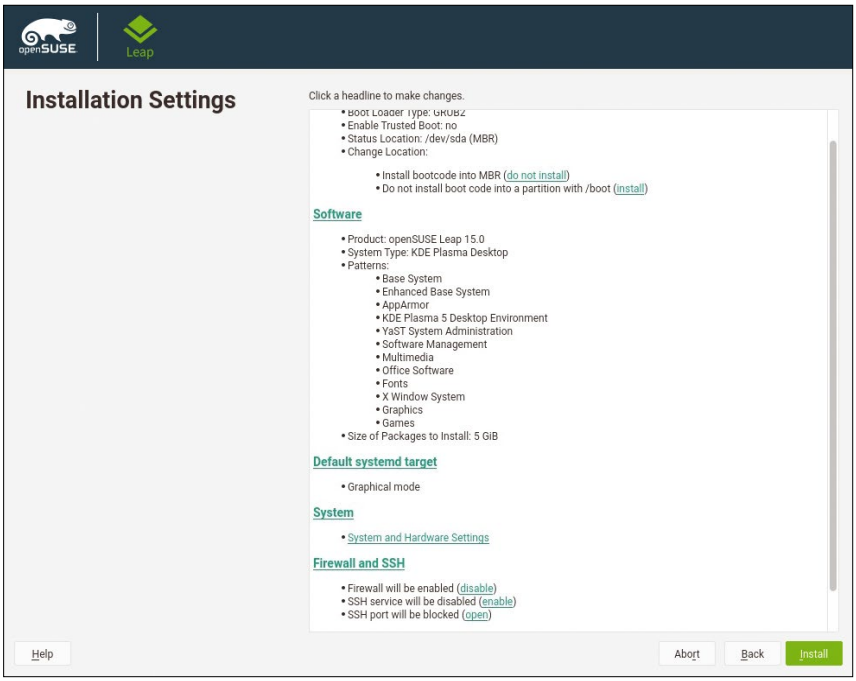


Figure 2: SSH and firewall configuration are set to their secure settings by default (bottom).

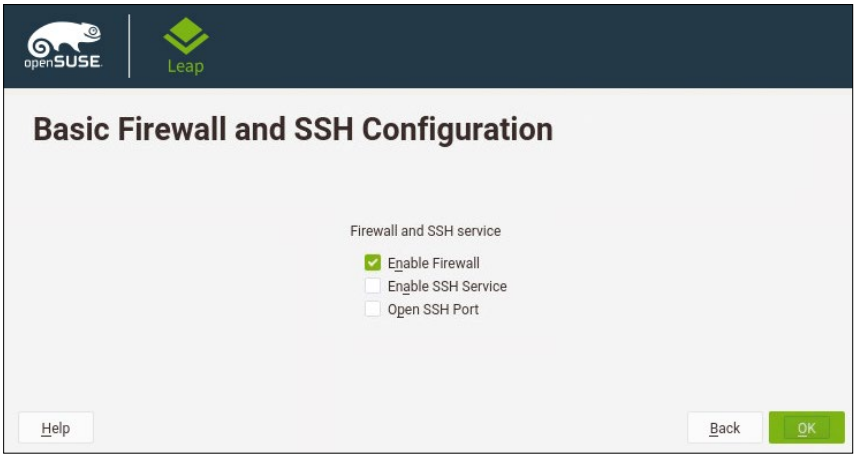


Figure 3: You can change the default settings in this dialog when you click on the *Firewall and SSH* link in the Installation Settings dialog.

Online Repositories

After the boot manager messages and the Language/Keyboard Agreement and Partitioning and Time Zone dialogs, the installation routine brings up the User Interface dialog. Unlike Windows or Mac systems, Linux, and especially openSUSE, comes with a generous variety of flavors for the desktop. *Desktop with KDE Plasma* is preselected, followed by *Desktop with GNOME* and *Server (Text Mode)*. If you are planning to set up a server and if you are experienced with remote access to Linux systems, then setting up the system in pure text mode might be a good option. Nevertheless, both Gnome and KDE are a good and safe choice for your Leap system. If you want other desktop environments, select *Custom* (see the article on Installation in this issue).

When installing openSUSE Leap 15, you can make some choices that affect the security of your system. One thing you definitely should do is click the *Configure Online Repositories* button at the bottom of the User Interface dialog to receive a list of online sources (Figure 1) that provide up-to-date software for your SUSE system, including recent security-relevant updates, patches, and fixes that are applied during installation. Of course, you can configure this after you system is up and running, but that would mean you are installing a potentially outdated system. The difference between online and local software will be small at release date, but it grows bigger every day, because thousands of developers all over the world are constantly improving their applications and fixing new found bugs in the software that comes with Leap.

Having a system that is always up to date with the newest software has one downside, which is why configuring online repositories isn't the default: Your machine will constantly download software from the repositories; thus, an Internet connection is needed and over the weeks hundreds of megabytes of traffic could easily accumulate. If you're fine with that, and if you always want to have the newest fixes applied to your system, you should activate online repositories during the installation process. Later, I'll show you how to set up your system for automatic updates.

Secure Passwords

Another dialog that comes up while you are installing your system is choosing a secure password. Although openSUSE Leap offers a standard password check with the CrackLib library, you should keep some basic facts in

mind: The longer and more random your password, the more secure it will be. Don't use short passwords, don't use dictionary words, and follow the guidelines of experts like Bruce Schneier [1].

Most important: Never reuse a password. Use unique passwords for every service; use completely random passwords, like those generated by tools like PWGen (see the "Secure Password Generation" box); and store you passwords in a password manager (which then becomes a single point of failure [2]) or write them down and put the note in a safe. Security and usability are often antagonists.

Once you've made it to the Installation Settings screen, only one entry is of importance concerning security: the *Firewall and SSH* section. As you can see in Figure 2, the best settings are already chosen: The firewall is enabled, remote access via SSH is disabled, and thus the SSH port is closed by the firewall. Figure 3 shows the dialog you are offered to change any of these settings.

SECURE PASSWORD GENERATION

PWGen is a nice tool for the command line that generates random passwords of specified lengths. It's simple to invoke with

```
pwgen <number of characters>
```

In the following example, PWGen comes up with secure passwords of 20 characters:

```
mfeilner@thinktank:~> pwgen 20
aigie1uh0aiXaibaisae sheengah4dah0goorohZ ooch2aoSioshahpheeKi
doojeiphuoQu8vai6yoo faeB6efae2Ko5iekohdu pelahR9iesei6eng8pho
eijeiChoore8ohNaiGhe fahm3Otaiwoogohwah5r Uoph0aiThahroh1ozieT
[...]
```

POST-INSTALLATION

Once the operating system is installed on your disk, you are the proud owner of a secure Linux desktop system – safe from viruses, malware, and, if you configured online updates, most of the known bugs. Your system is closed, and nobody can access services on your machine (see the "Wisdom of the Elders" box). If you want to keep it that way, don't install unnecessary software, only install applications and utilities from trusted resources (i.e., the SUSE repositories), and follow the guidelines in the Leap documentation [3]. Also, SUSE mailing lists and forums are a great place to ask questions and collect helpful advice.

SUSE's main setup tool, YaST (Figure 4), has several modules and an entire section that offer a variety of security-relevant settings (from top to bottom):

- *Software* | *Online Update*
- *System* | *Services Manager*
- *Network Services* – domain membership, single sign-on, remote administration (VNC), VPN, and other modules that supply services usually necessary in corporate networks
- *Security and Users* – all of this section
- *Miscellaneous* | *System Log* and *Systemd Journal*

WISDOM OF THE ELDERS

Most modern Linux distributions follow old wisdom from the world of Unix, an operating system that was designed in the 1960s and developed for high security and stability scenarios. Whereas proprietary software tends to concentrate on making things easy to use, Linux/Unix tend toward greater security. Although this emphasis can be annoying at times, in most cases it makes sense. For example, when you install modern Linux distributions, they will all be in the safest possible state considered usable by their developers. That usually includes a running firewall, with no services reachable from any network. The only connections your system should undertake are network services (DHCP) for the Internet and a time server (NTP) for accurate timekeeping.

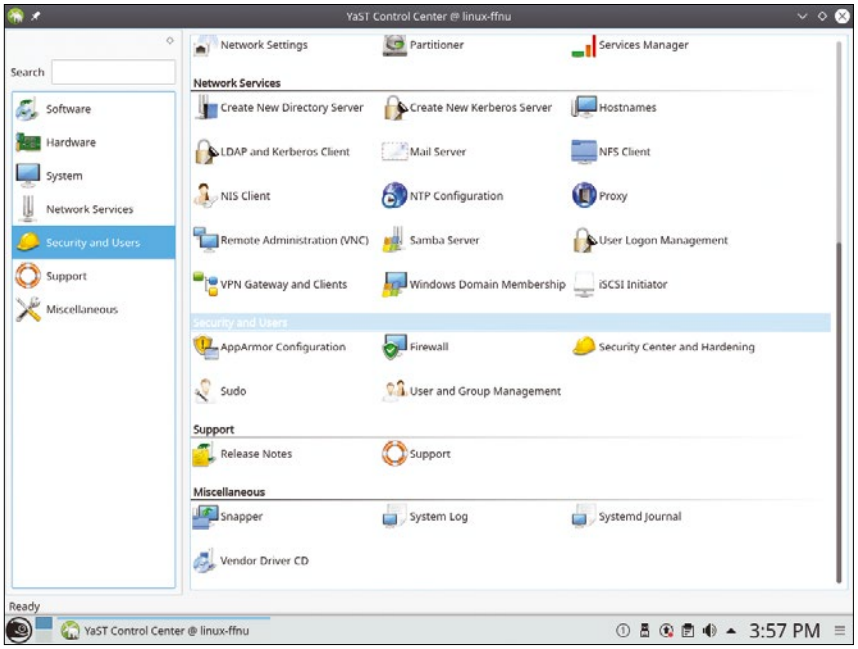


Figure 4: YaST is your portal to installing software on and configuring your openSUSE system.

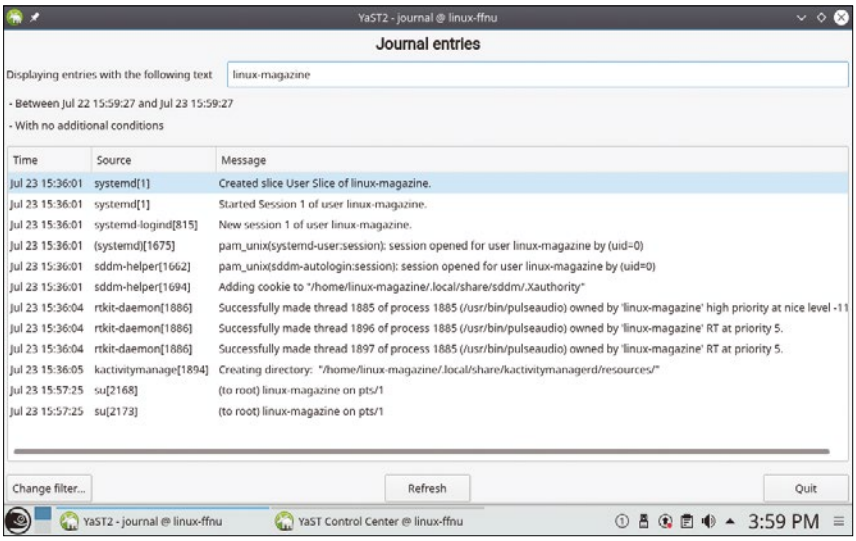


Figure 5: The systemd journal shows your Linux system logfile entries; you can easily find out who logged in and when.

Starting with the simple settings first, the two modules in the *Miscellaneous* section help you review events and check for "surprising" behavior, although you might need deeper knowledge to read and set up the files. The *System Log* module displays old-fashioned logfiles, whereas the *Systemd Journal* module shows the output of the systemd daemon, an almost universal daemon that handles large parts of modern Linux systems. The module lets you search for events with the use of filters (Figure 5). To try it out, search for your username.

Online Update

The *Online Update* module in the *Software* section offers the software selection dialog first. Select *Configuration* | *Online Update* from the menubar to configure the scope and time frames of regular, automatic updates. Leap will ask you to confirm installation of the YaST module that performs this task; click *Install* to proceed. Once installed (it might take a while), Figure 6 shows the window you should see. You can choose between daily, weekly, or monthly automatic updates and define the scope (including interactive patches, delta RPMs) and convenience (i.e., automatically agreeing to licenses and including recommended packages) of updates. Your mileage may vary, and depending on the purpose of your system, different settings might suit your setup better. The figure shows the default, which is reasonable in most cases. Again, Leap documentation [3] (and the online help) has more details on individual settings.

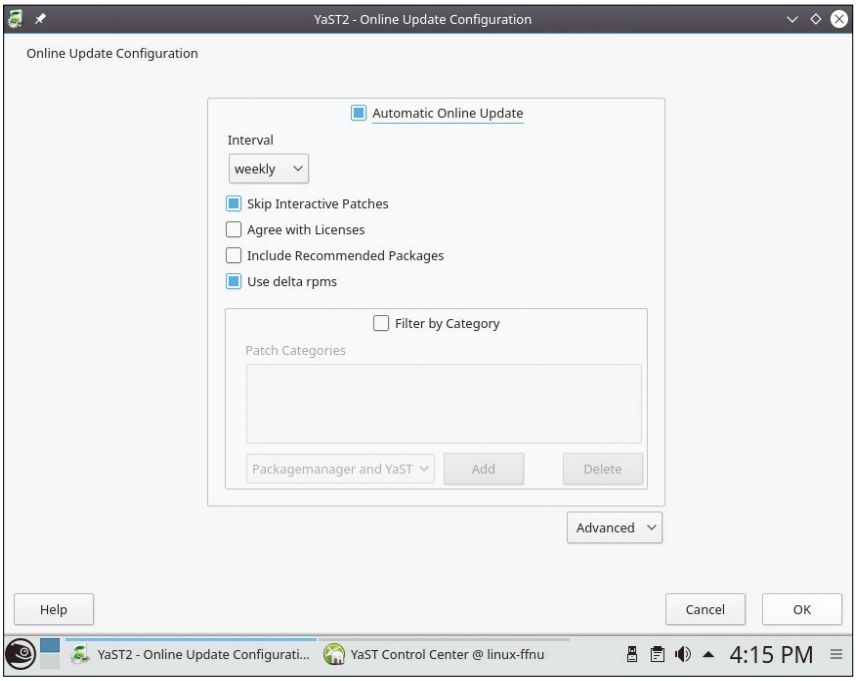


Figure 6: Daily, weekly, or monthly? How often should your Leap system fetch updates?

Managing Services

YaST's *Services Manager* module in the *System* section might seem familiar, because all of today's operating systems have a similar tool to start, stop, and configure services. Additionally, Linux offers several different modes of operation (e.g., headless, text-only). In this YaST module, you can choose to switch your system to a different mode (Figure 7). Just select one of the entries in the *Default System Target* drop-down menu and reboot. Be aware, though, that there's no easy way back from a text-only system to the GUI. You'll need to know about the text-only version of YaST or more about systemd configuration itself. I mention this here because many security experts consider a full-featured GUI unnecessary for servers, as well as a security risk because of the many programs it runs. Nevertheless, even with *Graphical Interface* selected, you can still choose to activate or deactivate services from the long list described on the right. Any new services you install are added to this list automatically.

Security and Users

The *Security and Users* module represents the core of security functions within openSUSE Leap. Here, you define firewall rules, specify hardening rules, and much more. This section holds a great variety of settings and tools that, if you had to buy them, would easily come to thousands of dollars. Several of these tools are very sophisticated, high-security tools that might seem difficult to handle or require intensive study before usage. The following paragraphs explain

their nature, but in the course of this article I will focus on three of them: *AppArmor Configuration*, *Firewall*, and *Security Center and Hardening*.

AppArmor

AppArmor is a extensive set of tools and profiles that defines a "standard" and acceptable behavior for programs. On the basis of experience and expected behavior, developers have compiled lists of what individual programs are allowed to do. If the program is corrupted by an attack, it could use the privileges of the initial program to do harm. AppArmor lets you modify and set up profiles that keep applications from accessing or executing non-standard actions. Thus, the AppArmor module has three basic functions: handling applications, setting up profiles, and managing profiled applications. If you start the module, you can choose to change settings, manage profiles, and add new profiles (Figure 8). Details about how to use this mighty tool can be found in the openSUSE Leap documentation [4].

Firewall

A major new feature in openSUSE Leap 15 is the way YaST manages the Firewall module: SUSE replaced its SuSEfirewall with the popular firewalld and the graphical management tool, Firewall-config, which appears with the name Firewall Configuration in the openSUSE GUI.

The Firewall Configuration tool displays a list of interfaces (Active Bindings), a drop-down Configuration menu where you can specify *Runtime* or *Permanent* configuration, plus the *Zones*, *Services*, and *IPSets* tabs (Figure 9).

Upon startup, you are presented with the *Services* tab in the *Zones* section (Figure 10). Select *eth0* as your standard device; it should be dubbed as a *public* zone. Usually, a zone is directly specified by a device, and vice-versa.

By simply clicking and activating a checkbox in the *Services* tab, you can open your system for remote access to the specified service. The *Ports* tab lets you specify services that are not yet in your list by defining port numbers and protocols (Figure 11).

Rich in details, Firewall-config provides a lot of options. Advanced users can adapt the firewall settings using the following tabs:

- *Services*
- *Ports*
- *Protocols*

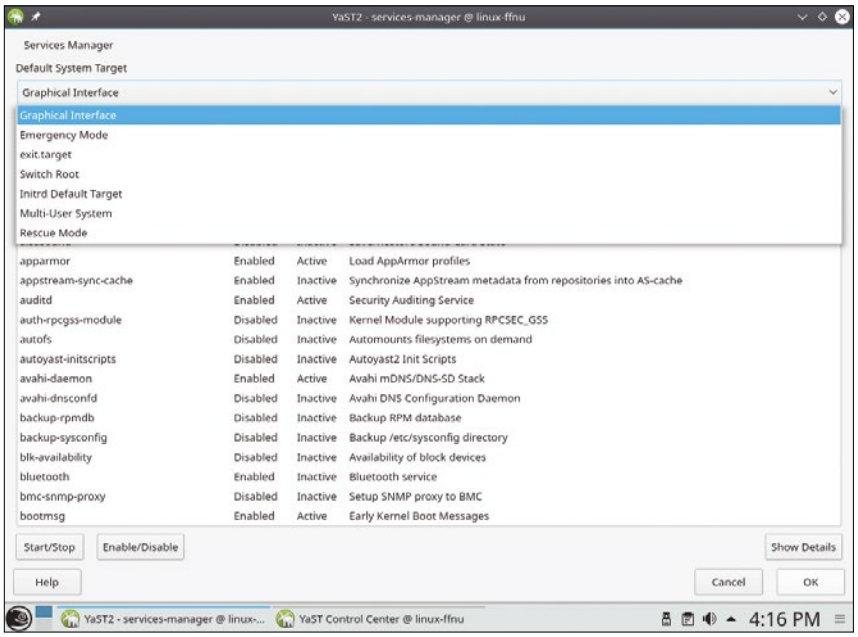


Figure 7: YaST's Services Manager dialog lets you decide which services should and should not start automatically.

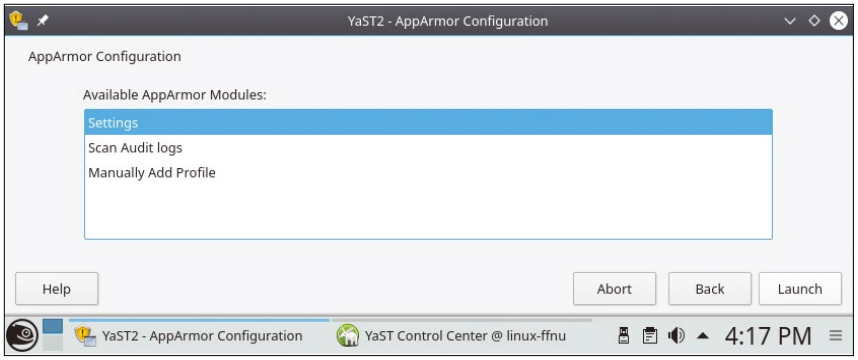


Figure 8: AppArmor is a mighty and complex tool that supports application profiles to prevent non-standard behavior.

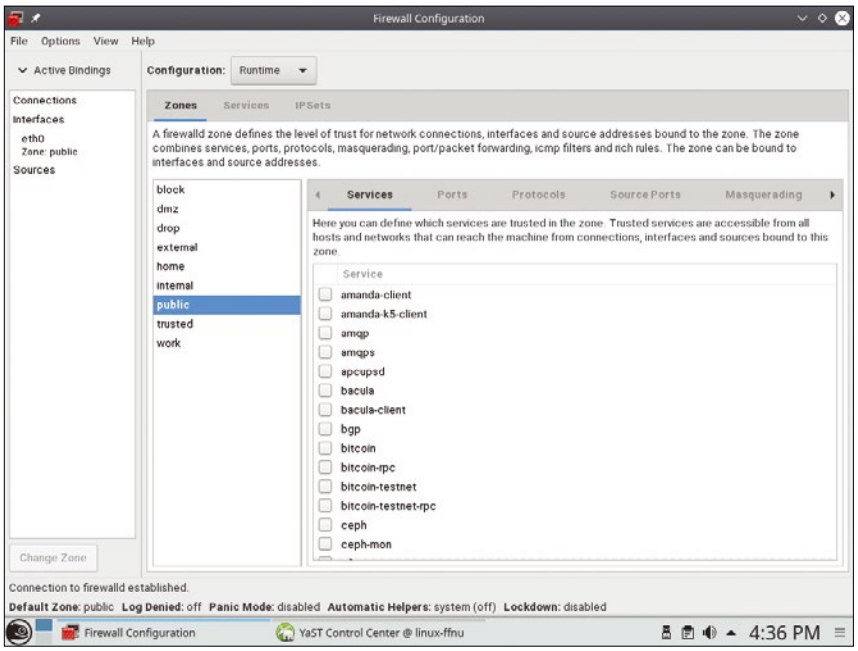


Figure 9: The Firewall Configuration tool (Firewall-config) lets you configure settings for managing firewalld.

- *Source Ports*
- *Masquerading*
- *Port Forwarding*
- *ICMP Filter*
- *Rich Rules*
- *Interfaces*
- *Sources*

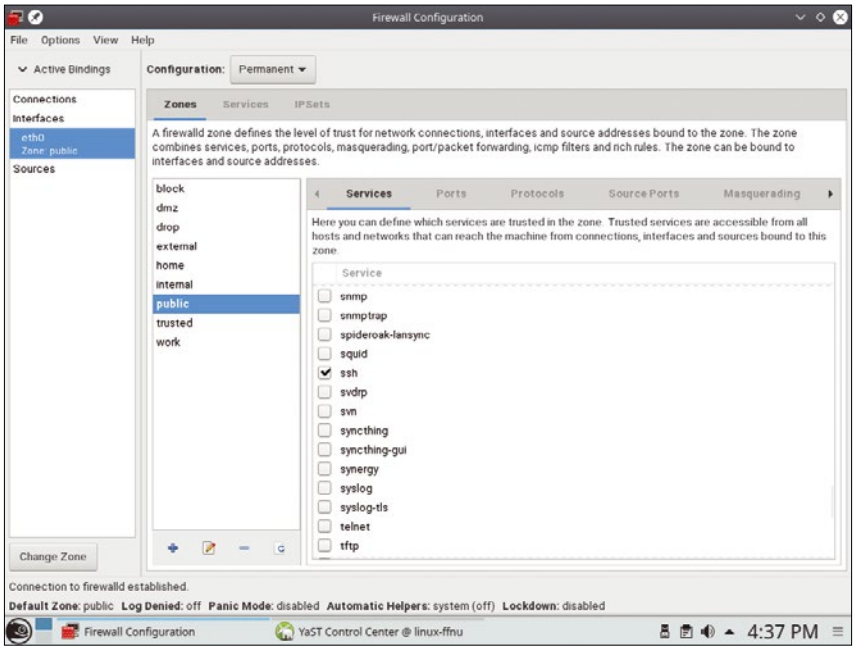


Figure 10: Choosing the right zone for your firewall is only necessary if you are setting up a router.

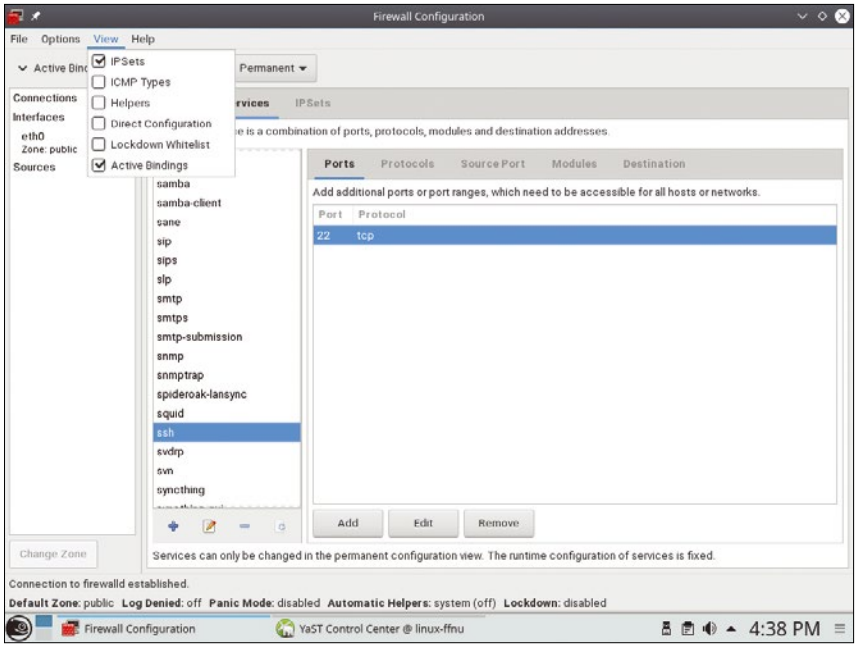


Figure 11: Punching a hole in your firewall for SSH.

TABLE 1: Examples of Useful Commands

Command	Function
`zypper`	Software and repository management to install/remove/find/update software
`iptables`	Low-level Linux kernel tool for managing firewalls
`tcpdump`, `iptraf`	Low-level tools for network traffic inspection

On top of that, you can always add your own rules, zones, ports, or other details by clicking on the *Add* or + buttons (if available).

Firewalld lets you define runtime settings that apply to the firewall currently running in the kernel but are not part of the permanent configuration. I suggest the following workflow for your firewall configuration: Play around to find a working solution for your runtime configuration, test it, and then make it permanent by clicking on *Runtime to Permanent* in the options menu. If you find yourself locked out during testing a runtime configuration, simply reboot the system to gain access again.

You can also manage firewalld from the command line using the command `firewall-cmd`. If you have used SUSE before and want to upgrade your existing SuSEfirewall rules for the new firewalld system, you can install a helper script with:

```
# zypper install susefirewall2-to-firewalld
# susefirewall2-to-firewalld
```

For documentation on Firewall-config and `firewall-cmd`, start with the openSUSE website [5] and the `firewall-cmd` man page [6].

Security Center and Hardening

Finally, the YaST Security Center module focuses on making your machine even more secure through hardening, which is a process that goes beyond standard security measures. Many settings that are not easily understood can prove very helpful, although they could make your system unusable, as well (much like messing with the Windows registry database).

Security Overview shows all your settings at a glance (Figure 12). The *Predefined Security Configurations* tab lets you choose whether your machine is a workstation, a roaming device, or a network server. YaST then uses profiles to determine the appropriate settings for the typical user's needs. In the *Password Settings* tab, you define the length, encryption method, and aging out of user passwords. *Boot Settings* and *Login Settings* help guard against attackers with physical access. If you feel like changing the range of user or group IDs for new users and groups, use the *User Addition* tab. Finally, the *File Permissions* drop-down menu under the *Miscellaneous Settings* tab makes it easy to protect (e.g., config) files on your system. The standard profile is *Easy*; setting it to *Paranoid* might be more secure, but, as the name suggests,

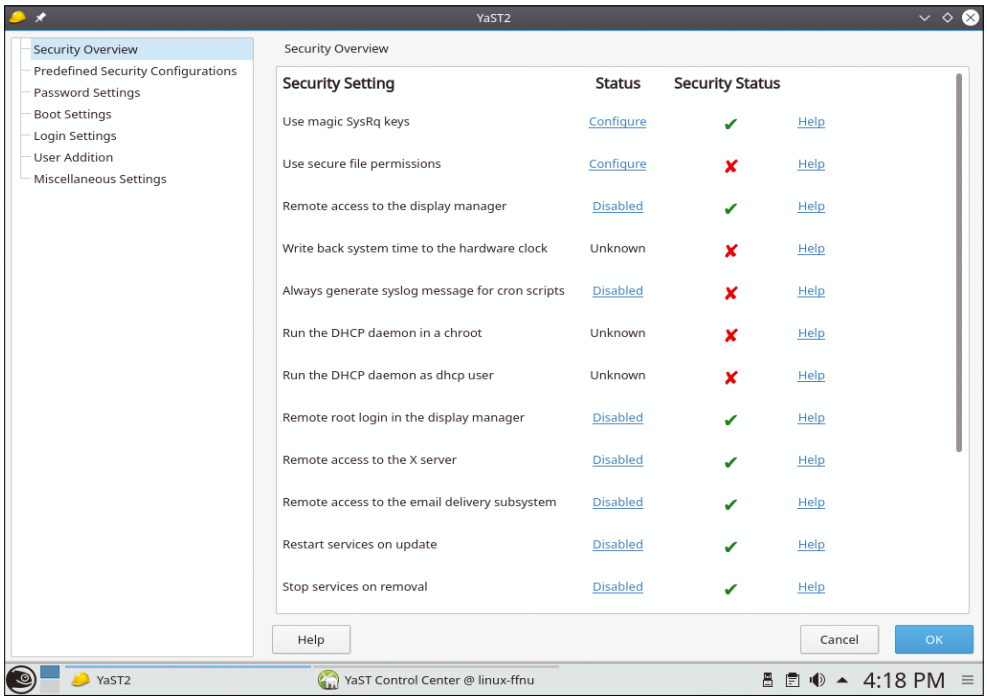


Figure 12: You have complete control over the security of your system in the YaST Security Center and Hardening dialog.

you might find that some things will not work properly afterward.

So Much More

Although I have covered a lot in this article, there is so much more: user and group management, `sudo`, PolicyKit, Access Control Lists (ACLs), filesystem encryption, using and configuring SELinux, not to mention End of Life issues (see the "Version Lifespan" box). OpenSUSE Leap brings many high-end security features to your desktop, and you have additional scope for control over your system's security from the command line (Table 1). With safe startup settings and no viruses or spyware, Leap will keep your system above the malware fray. ■

INFO

[1] Bruce Schneier on secure passwords: *https://www.schneier.com/blog/archives/2014/03/choosing_secure_1.html*

[2] Single point of failure: *https://en.wikipedia.org/wiki/Single_point_of_failure*

[3] openSUSE Leap 15 documentation: *https://doc.opensuse.org*

[4] AppArmor docs: *https://doc.opensuse.org/documentation/leap/security/html/book.security/part.apparmor.html*

[5] firewalld: *https://en.opensuse.org/Firewalld*

[6] firewall-cmd man page: *https://firewalld.org/documentation/man-pages/firewall-cmd.html*

[7] openSUSE Leap lifetime: *https://en.opensuse.org/Lifetime*

[8] CVEs: *https://cve.mitre.org/about/*

VERSION LIFESPAN

All good things must come to an end. Just like other operating systems, such as Mac OS and Windows, Linux/GNU distributions also have major and minor versions that are released periodically and supported over a specific period of time. Some distros offer Long-Term Support (LTS) versions, which last for several years, whereas other releases only receive months of support.

WHY YOU NEED TO UPGRADE

Newer versions of an operating system receive security and maintenance updates, whereas older versions are eventually discontinued and reach an End of Life (EOL) phase. Those who continue to use EOL versions could be exposed to vulnerabilities because they no longer receive security and maintenance updates. Consequently, users need to upgrade to a newer minor or major version.

Leap's lifetime is associated with the Service Pack lifetime [7]. With openSUSE Leap, newer versions are released about once a year, and the previous version is discontinued six months after the newest version is released. For example, openSUSE Leap 42.1 (Service Pack 1) was released in November 2015; the next version, Leap 42.2 (Service Pack 2), was released in November 2016; accordingly, Leap 42.1 was discontinued in May 2017. OpenSUSE Leap 42.3 (Service Pack 3) was released in July 2017, which means it will likely receive security and maintenance updates until late 2018 or early 2019. Therefore, the total lifespan of version 42 will exceed three years. OpenSUSE users should upgrade their systems to a supported release to receive security updates and community support.

The lifetime of a new major version release will also affect the EOL of previous minor version releases. Going forward, new versions will continue with the same policy of being discontinued six months after the newest version is released.

The power and uniqueness of openSUSE Leap is that both SUSE engineers and openSUSE community members contribute to the development, security, and maintenance of the distribution, which means users can be confident that their openSUSE operating system is receiving bug fixes and updates that help avert security risks that might let a hacker penetrate the operating system.

Using a supported version is important. Just how important? Consider this: One minor version of openSUSE that was supported from November 2014 to January 2017 fixed more than 2,650 Common Vulnerabilities and Exposures (CVEs) [8] and 3,900 bugs.

That is a lot.

– Douglas DeMaio
Public Relations expert for the openSUSE Project

Exploring openSUSE's KDE Plasma desktop

Getting Started

openSUSE's KDE Plasma desktop is not only pretty, it is also piled high with cool features. Here's what Plasma can do for you. *By Paul Brown*

Modern Linux operating systems have a fully formed graphic user interface, like Windows or Mac OS. When you boot into the system, you will see icons, menus, and a mouse cursor, as you would with any other operating system.

Linux actually supports several different desktop interfaces. If you installed the openSUSE Linux system on the DVD attached to this issue, the default desktop is KDE Plasma. This article will show you around the Plasma desktop and will help you get started with configuring and exploring KDE.

If you're using a Linux version with a different desktop, check your distro's documentation sources for a similar article on getting started.

KDE Plasma

OpenSUSE installs KDE's Plasma desktop by default (Figure 1). Plasma is an advanced (some would say *very* advanced) desktop, which comes with so many features that you would probably need a hefty book to describe them all. But don't feel intimidated! You will definitely not need everything to start with, and, after some practice, a lot of what may seem initially exotic will turn out to be useful and easy down the road.

Plasma Basics

Plasma (see the "Plasma by KDE" box) is very similar in layout to desktops used on other systems. In fact, you may find it looks rather like Windows XP or Windows 7. If you look at Figure 1 again, most things should be recognizable.

As with most modern desktops, you can drop items on the desktop to create a shortcut. You can drop apps, folders, or files on the desktop, and they will show up as desktop icons in most cases, or, sometimes as mini-previews if they are images or documents.

To create a shortcut on your desktop, you can drag items from practically anywhere: Click on the Home folder located on your desktop, and it will open in Dolphin, Plasma's file manager. You can drag and drop

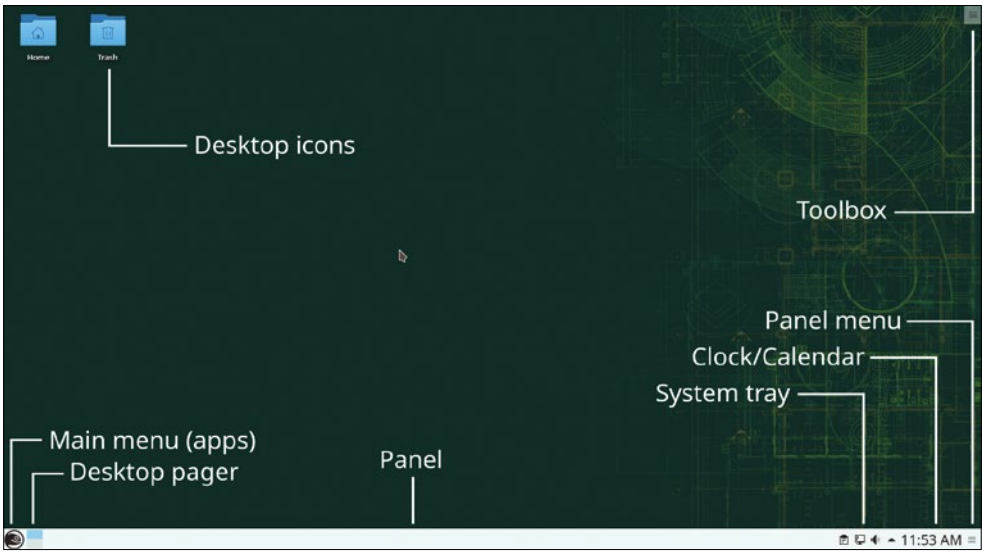


Figure 1: The Plasma desktop's default look on a freshly installed system.

files and folders directly from Dolphin onto the desktop. If you want to create a shortcut to an app, open the main menu (see Figure 2), mouse over any of the sections, such as Graphics, and a submenu with apps opens. You can then click, drag, and drop any entry in the submenu (for example, *GIMP*) and place it onto the desktop.

Each type of shortcut will behave as you expect: Apps run when you click on them, folders open in the file manager (by default Dolphin), and files open in the apps that are associated with them – images open in an image viewer, text documents open in a word processor, and so on. (See the "Move, Copy, or Link?" box for more information on creating shortcuts.)

The All Powerful Panel

Along the bottom of the screen, you'll see a gray bar, which is the panel. On the left is the main menu button mentioned earlier. Click on that, and you can navigate through the different types of apps preinstalled with openSUSE. For a complete list, see Table 1.

To left of the menu is a narrow column showing icons of some apps. These are your favorites – apps that you use often and need to access quickly. By default, openSUSE gives you Firefox, Settings, Dolphin, and Kate as favorites. You can add more by looking for the desired app in the main menu, right-clicking on it, and picking *Add to Favorites* from the pop-up menu that appears. You can remove a favorite by right-clicking on it in the main menu and picking *Remove from Favorites*.

To the right of the main menu button, you'll find the Pager. Linux differs from many other operating systems in that it supports more than one desktop space since … well, a very, very long time ago. The Pager helps you switch between desktops. By default, you start out on Desktop 1, which is represented by the upper rectangle in the Pager. You can open and work with apps on this desktop. Then click on the lower rectangle and move to Desktop 2, where you can work with completely different apps.

You can do the same, by the way, with the mouse wheel: Place your cursor on a free space on the desktop (that is, a space not covered by an app window), and roll the wheel. You'll see your windows scroll up as you slide onto your other desktop. Continue rolling the wheel, and the windows on Desktop 1 will scroll back down again. If you right-click

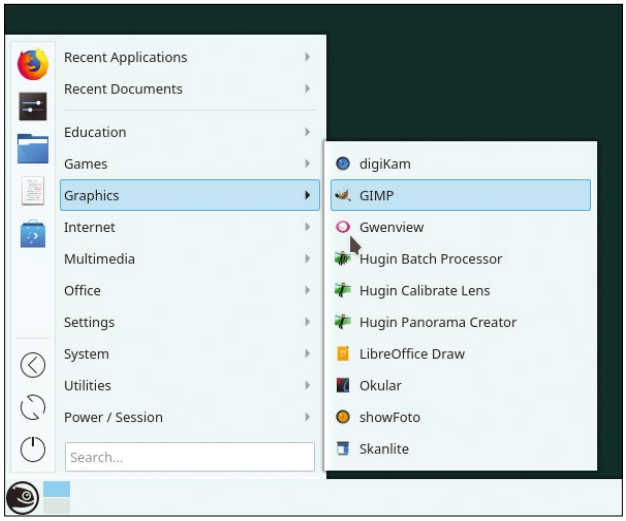


Figure 2: Plasma's main menu with the Graphics section open. Also, to the left of the main menu's start button, you can see the desktop pager with two desktops.

PLASMA BY KDE

OpenSUSE's default desktop is called Plasma. Plasma is developed by KDE [1], a worldwide community of volunteer developers. The KDE community also creates many of the apps that come with Plasma and has a weakness for the letter K (in fact, KDE's logo is the letter K embedded in a gear). They also tend to use K somewhere in the name of their apps: Krita (an advanced painting program for designers), Kate (a text editor), and Kontact (a suite of communication and productivity apps).

MOVE, COPY, OR LINK?

When you drop something on the desktop or into another folder (the desktop acts just like a regular folder), Plasma will ask you whether you want to move, copy, or link to the item.

If you move the item, you erase it from its original location and create a new copy in the new location. So if you move an image from your Pictures folder to the desktop, it will disappear from Pictures and will reappear on the desktop (in the Desktop folder). This is good for files when you don't want duplicates scattered all over your hard disk. It is not such a good idea if you are dealing with folders and apps. If you move an app, it may stop working, because the system looks for apps in certain folders, and outside those folders, it won't be able to find them.

If you decide to copy the item, you create a new replica of the original in the new location, but the original will not be affected. This is a good idea if you want to keep the original and want to work on or modify a copy. The disadvantage is that you can end up with several copies of identical files in different places on your hard disk, taking up unnecessary space. Modern hard disks tend to be huge, so this is not a terrible problem, but it is inelegant.

If you create a link to the item, Plasma creates a little text file that tells the system where it can find the original file, folder, or app. A link functions like a road sign, telling the system where to go to find the original. To the user, a link looks like the original and will act like the original (a link to an app will run when you click on it, a link to a folder will open it in the file manager, and a link to a file will open it in the appropriate app), but it isn't the original. This is ideal for apps and folders you want to put on your desktop: You are still creating a shortcut to them, but you don't disturb them from where they live.

TABLE 1: The Main Menu

Section	Contents	Example Apps
Education	Educational apps and games	Marble, a map navigator like Google Earth
Games	Your typical selection of time wasters	Patience, Minesweeper, Mahjong, etc.
Graphics	Image viewers and editors	Gimp, an advanced image editor
Internet	Apps for using the Internet	Firefox, a web browser, and KMail, a full-featured email client
Multimedia	Music and video players and editors	Dragon Player, a video player, and K3B, a CD/DVD burner
Office	Productivity apps	LibreOffice, an office suite including a word processor, spreadsheet app, presentation editor, etc.
Settings	Applications that help you configure your desktop and printers	Configure Desktop, which allows you to configure Plasma, and YaST, openSUSE's system configuration control center. YaST allows you to do nearly everything, from installing new software to setting up your firewall. You can do so much with YaST that we have a whole article dedicated to this topic in this issue.
System	More tools to manage your system	KGet, a download manager, and Dolphin, a file manager
Utilities	Desktop utilities	KCalc, a calculator app, and Spectacle, a screen-capture utility
Power/Session	System state and user switcher	Options to turn off, reboot, suspend and hibernate your computer

on the pager, you can add more virtual desktops.

Moving along towards the right on the panel, you have the Task Manager. When you don't have any apps open, this will look like an empty gray expanse. But, the moment you run a program, a rectangle with the app's icon appears. If it is available, the name of the file it is showing will also be visible. If you hover over the rectangle, you'll be able to see a preview of the app's window (Figure 3).

This is more than just pretty: It is also practical. If you open multiple text documents using, for example, LibreOffice, to save space, the Task Manager may bundle all of them together in one rectangle and show a little + symbol in a green circle under the icon. Hovering your cursor over the rectangle brings up a preview, as mentioned before, but in this case it will show all of that app's open windows. You can then move your cursor along the previews and select the one you want to view or even close them selectively using the *x* button that appears in the upper-right corner of each preview.

Further to the right on the panel is the System Tray. This contains utilities and useful system tools. For example, click on the network icon (it looks like a computer monitor with a cable running down its left side), and you'll be able to choose between a wired and wireless connection. If you choose the latter, you will see all the available WiFi networks. You also have volume control and, hidden under the arrow icon on the right, more options and tools (Figure 4).

Especially interesting in this list is the *Software Updates* utility. This will show up in the System Tray when updates become available. Click it, and you'll be able to download and install important updates without leaving the desktop (Figure 5).

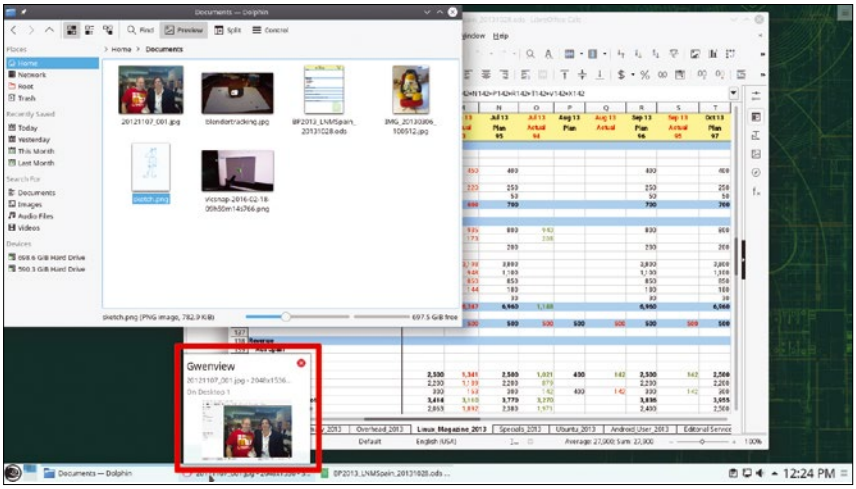


Figure 3: The Task Manager shows you which windows are open even if they are hidden behind others. It also shows you a preview of what file is open in each app.

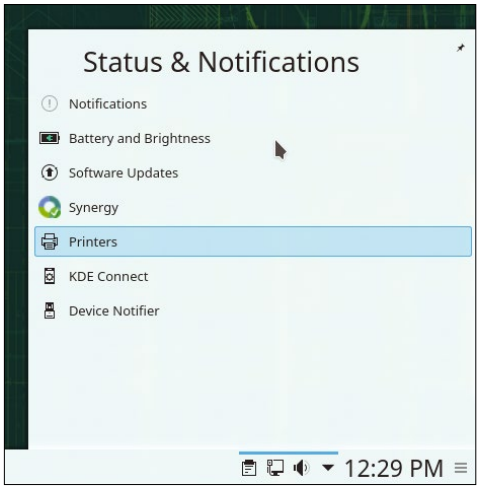


Figure 4: The System Tray hides more utilities under the arrow on the right.

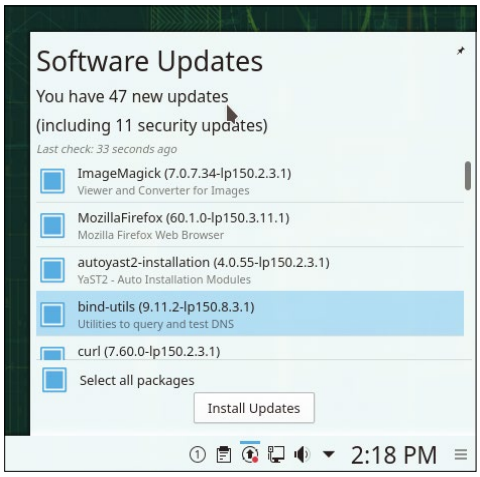


Figure 5: The Software Updates utility allows you to install updates without leaving the desktop.

Also check out *KDE Connect*, a utility that allows you to pair up your Android phone with KDE. You need the KDE Connect app on your phone (available from F-Droid [2] or Google Play [3]). When paired, you can easily copy files to and from you mobile device, receive notifications from your phone on your desktop, use your phone as a touchpad to move the cursor on your desktop or as a remote control for your media players, and much more. KDE Connect is very useful and a lot of fun.

Next up is the Digital Clock/Calendar. You may think this is pretty boring, but even this hides at least one cool feature: Click on the clock, and the calendar will pop up. Right-click on the calendar, and choose *Digital Clock Settings* from the pop-up menu. In the *Calendar* tab, click on *PIM Events Plugin* (PIM stands for Personal Information Manager). In the *PIM Events Plugin* tab, you'll be able to connect your events and tasks from KOrganizer – the calendaring app that is part of Kontact, the email, calendar, and contact suite. With this, you will always be able to see what's next on your agenda without having to open another program (see Figure 6).

Finally, at the right end of the panel is the Panel Settings menu (Figure 7). Click on it, and you can change the size of the panel (icons and widgets will scale accordingly); move it to the left side, right side, or top of the screen. Move widgets on the panel around, add more widgets, or delete the ones you don't use.

Speaking of Widgets

Widgets are also affectionately called plasmoids in Plasma parlance. They are the little graphical utilities that make your life easier or more fun. There are boring, but necessary widgets, like all the clocks and calendars (the standard digital clock mentioned above is a widget), user switchers, and CPU and disk usage monitors. Also, there are fun widgets, like comic readers and puzzle games.

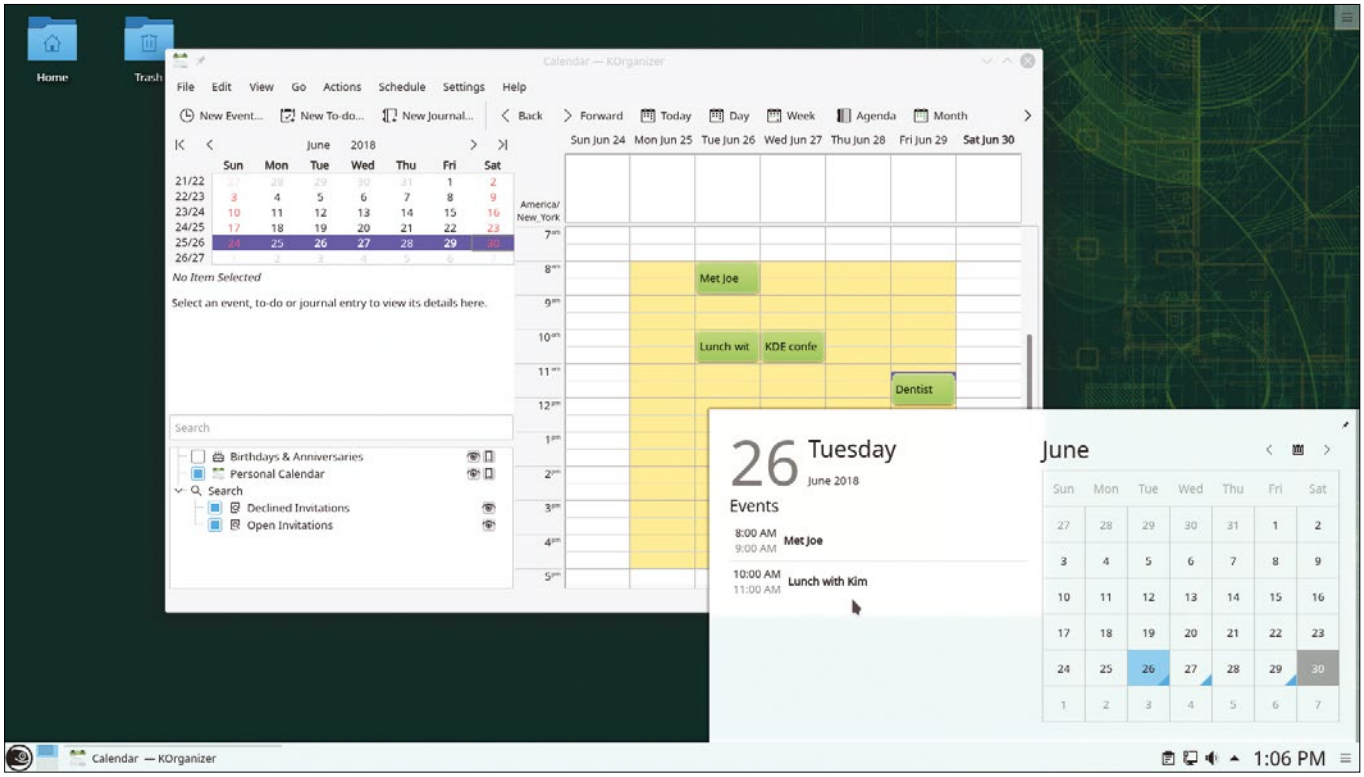


Figure 6: You can synchronize your to-do list and appointments with the calendar widget.

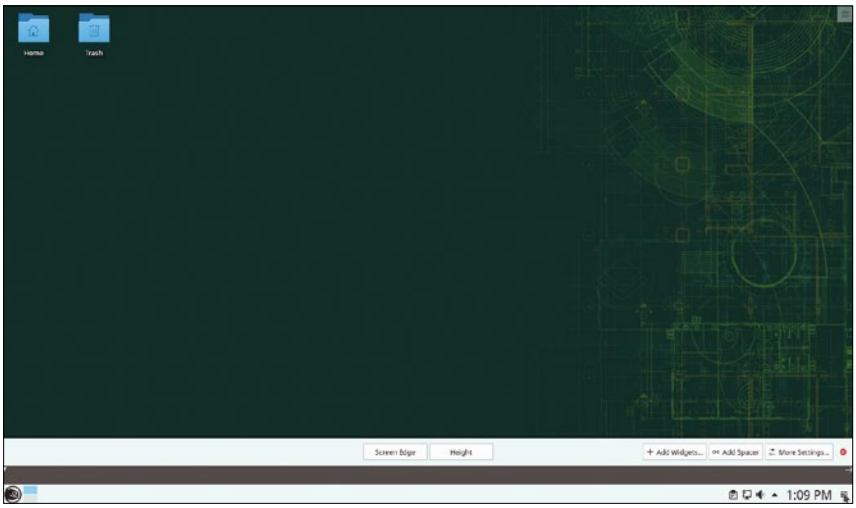


Figure 7: The Panel Settings menu lets you change everything on the panel.

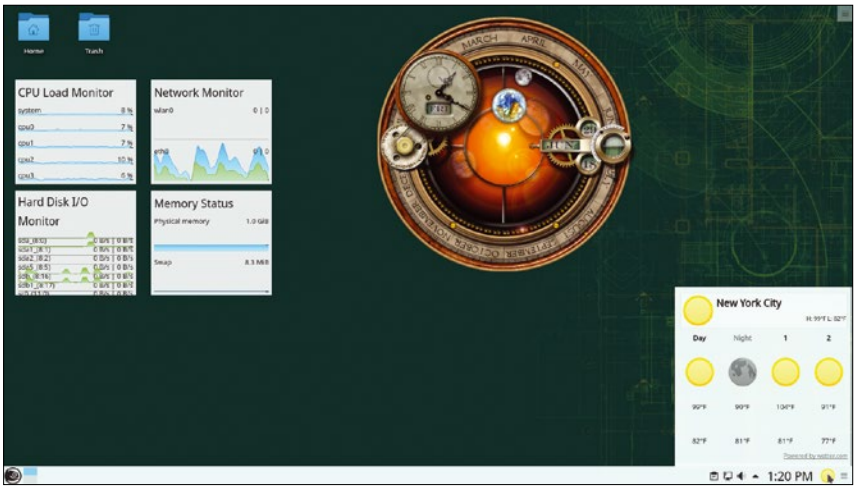


Figure 8: Widgets (or plasmoids) can be added to the desktop and the panel.

You can install plasmoids onto the panel or directly onto the desktop, as shown in Figure 8. To add plasmoids to the desktop, click on the Toolbox menu in the upper right hand corner of your screen, and choose *Add Widgets*. A catalog with all the available widgets will open on the left, and you can pick and choose the ones you want.

At the top of the plasmoid catalog, you will see a magnifying glass icon that allows you to search the widgets using keywords and, next to it, a funnel icon that lets you filter by type. At the bottom, you can click on *Get new widgets*, which lets you install a downloaded widget from the Internet or open an online "widget store" and install widgets from there.

Once you have installed and placed your widget/plasmoid on your desktop (Figure 8), click on it and hold to drag it around. A bar will also appear to one side of the plasmoid that allows you to rescale the widget or to tip it one way or another. This isn't terribly useful, but it does go to show the flexibility of Plasma's plasmoid engine.

Gestures

Speaking of moving things: You can accomplish a lot just by dragging windows. If you move an app's window to the top of the screen, it expands and maximizes to your screen's full size. Drag it to the edge of screen, and it snaps and resizes to take up exactly half of the screen. Drag it to a corner, and it resizes to take up a quarter of the screen. This is useful if you are working with several apps simultaneously, and you have to drag and drop objects from one to the other.

If you move the cursor to the upper left corner of the screen, Plasma shows you all the open windows spread out over the desktop (Figure 9). You can then move the cursor over the window of the app you

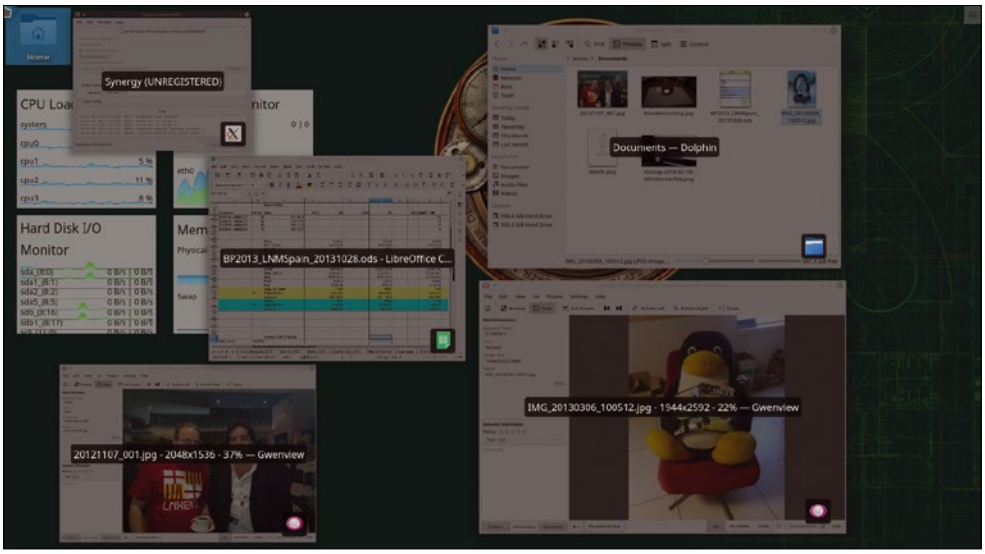


Figure 9: You can see all open windows by moving the cursor to the screen's upper left corner.

want to use, click it to bring it to the front, and start working with it. This is useful if you have lost your bearings and want to quickly access a window that is hidden under another. Similarly, by holding down Alt + Tab, you can flip through open windows until you reach the one you want. The available windows will appear in a column on the screen's left.

MORE PLASMA

Plasma is so stuffed with features, it is impossible to cover everything you can do in one article. For ways to personalize your desktop experience, see the "Five Cool Customizations" box. The key with Plasma is to explore. Only by exploring will you be able to make the most of everything Plasma has to offer. ■

FIVE COOL CUSTOMIZATIONS

1. Application Dashboard: I personally do not like the main menu used to launch applications. I much prefer a plasmoid called Application Dashboard. Use the Panel menu to get rid of the default main menu launcher and add Application Dashboard from the plasmoid catalog. Drag it along the panel to the left to where the default main menu widget used to live. Now, every time you click the openSUSE symbol, you get a full-screen, translucent dashboard from which you can pick and choose which apps to launch (Figure 10).
2. Clementine: Clementine is fantastic music player that supports all the major formats, including MP3, OGG, FLAC, and WAV. Install it from YaST's software manager, and enjoy a much more chic music experience.
3. Connect to the rest of your network or the cloud: Dolphin, Plasma's file manager, is perfectly capable of showing remote file shares as if they were local. Open Dolphin and, in the left-hand column, under *Home*, click on *Network*. You will be able to connect to SAMBA, SSH, FTP, and WebDAV servers and navigate to them as if they were part of your hard disk. You can also use Nextcloud folders in the same way, but first look for `nextcloud-client-dolphin` in YaST's software manager to install the correct drivers.
4. Change your desktop background: OpenSUSE's default desktop background is elegant, but a bit dark. If you like something brighter, right-click on an empty space on your desktop, and pick *Configure Desktop* from the bottom of the pop-up menu. By default, you only have two options: OpenSUSE's wallpaper and Plasma's default wallpaper. The latter is bright and, in my opinion, pretty. However, if you want to see something else, click on *Get New Wallpapers*, and you can download whatever tickles your fancy from KDE's online catalog.
5. Learn about Plasma Activities: Plasma Activities are like meta-desktops. When you log in to Plasma for the first time, you are accessing the Default activity, with its desktops, widgets, panels, etc. However, you can create as many activities as you want, all with their own distinct look and feel. If you have a laptop with a touchscreen, for example, you could create an activity with big icons and no panel, to make it easier to use when in touchscreen mode, while leaving alone the default layout for when using your laptop normally. You can learn more about Plasma Activities online [4].

Figure 10: The Application Dashboard looks way cooler than the default menu. It is also arguably easier to use.

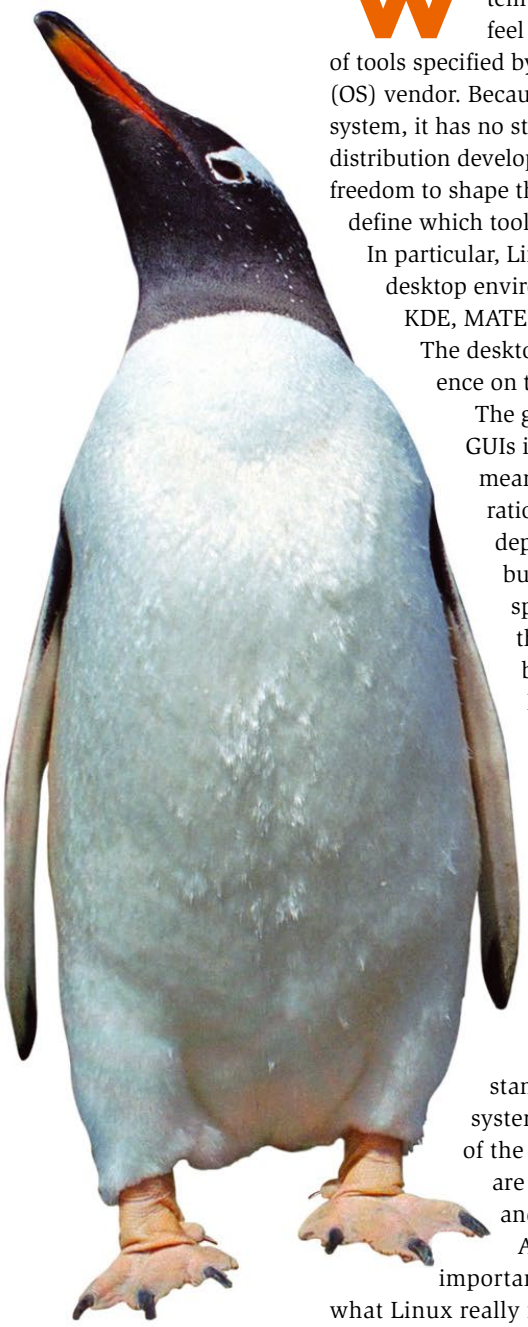
INFO

[1] KDE: *https://www.kde.org*
[2] KDE Connect on F-Droid: *https://f-droid.org/packages/org.kde.kdeconnect_tp/*
[3] KDE Connect on Google Play: *https://play.google.com/store/apps/details?id=org.kde.kdeconnect_tp&hl=en*
[4] Plasma Activities: *https://userbase.kde.org/Plasma#Activities*

An introduction to some fundamental Linux concepts

Crash Course

This brief look at some important Linux concepts will help you start thinking like an experienced user. *By Paul C. Brown; revised by Joe Casad*



When you start up Windows or Mac OS, you boot into a system with a single look and feel and a standard collection of tools specified by the operating system (OS) vendor. Because Linux is a free software system, it has no standard "look." Individual distribution developers have much more freedom to shape the user experience and define which tools are present by default. In particular, Linux supports several GUI desktop environments, such as Gnome, KDE, MATE, Cinnamon, and Xfce. The desktop can have a huge influence on the system's appearance. The great variety of tools and GUIs in the Linux environment means that standard configuration tasks might be different depending on which distribution you are using. This special edition is based on the openSUSE Linux distribution with the KDE's Plasma desktop. If you are using a different Linux distro (such as Ubuntu or Red Hat Enterprise), you might find different configuration utilities and discover that menus are in different places. However, when you get accustomed to Linux, you'll start to understand that all these Linux systems are similar and many of the underlying components are the same. (See the "GNU and Linux" box.)

A few basic concepts are important for understanding what Linux really is and how it works. This crash course will introduce you to some Linux fundamentals.

The Filesystem

For newcomers to Linux, one of the most bewildering things is how the filesystem hierarchy – the set of directories and subdirectories and the files they contain – is organized. Although you might have a hard time finding things in the beginning, the filesystem structure is highly logical, and you will find the same basic layout on all Linux distributions.

The Linux filesystem is organized into a tree. The bottom-most directory, from which all others sprout, is called the `root` directory and is designated with a slash (`/`). The root directory contains a series of subdirectories, such as `/bin`, `/lib`, and `/home`, which in turn contain more subdirectories, and so on. Figure 1 shows part of the Linux directory tree.

In openSUSE, you can see the contents of `/` by opening the Dolphin file manager and

GNU and Linux

The name for the Linux operating system comes from the kernel name. The Linux kernel is a single component down in the heart of the system that performs tasks such as running processes and controlling the hardware. A full-blown OS also contains hundreds of other components, including services, applications, configuration utilities, and programming interfaces. Many of the components within Linux were created by the GNU project, which is why many experts refer to the system as GNU/Linux.

Other components have found their way into Linux through the years – some contributed by independent developers and some by the companies that work with Linux. The GNU Public License (GPLv2) used with Linux systems ensures that improvements made to the Linux environment will be available to the whole community.

clicking twice on the arrow pointing up in the toolbar. If you are using the command line, you can type:

```
$ ls /
```

The names of the directories are not arbitrary. All `/bin` and `/sbin` directories, for example, contain executable files, which are programs you can run (although, despite what the names of these directories imply, not all of the executable files are binary files). You will find `bin` and `sbin` directories hanging off the root directory and then again within the `/usr` directory; the root `bin` and `sbin` directories contain the bare essential programs that the OS needs to work, whereas the `bin` and `sbin` directories in `/usr` contain extras. Thus, you will find an essential program like `mount` in `/bin`, but, if you install a game, you will probably find it in `/usr/bin`.

Some Linux distributions have joined both sets of directories so that you have only `bin` and `sbin` directories hanging off `/usr`. If you're wondering about the differences between `bin` directories and `sbin` directories, `sbin` directories usually contain programs that are reserved for the administrative user, or superuser. (See the "Superuser" box.)

If you want to know where a certain program lives, you can use the program `which` plus the name of the app from the command line, as follows:

```
$ which ls
/bin/ls
```

I will not delve too deeply into what each directory is for, but you must know that users' directories hang off `/home`. A user can create, modify, and delete files and subdirectories in their own home directory.

If you want to attempt the same activities in other directories (e.g., in `/`, `/etc`, or `/usr`), you will need special privileges – usually superuser privileges. Please note that tampering with files outside your `/home` directory is dangerous and can lead to malfunctioning programs or even a trashed system.

Navigating the Shell

The shell has often been described as "unfriendly," but a more correct term would be

SUPERUSER

For security reasons, it is better not to give an everyday user account access to the whole OS. Most systems limit the end user's privileges and rely on an administrator account with expanded privileges for performing system-level tasks, such as starting or stopping services, creating user accounts, and accessing system directories. Traditionally, many Linux distros had a completely separate account for the superuser (also known as `root`), and the system administrator only accessed the superuser account for important system administration tasks. To access this superuser account, the sys admin could do either of the following:

* Log in as root.

* Use the `su` command to *s*witch user to superuser.

Another approach has gained popularity in recent years. The `sudo` command lets a user run a command under the privileges of another user – by default, the superuser. To give a user access to the `sudo` command, add the user to the `/etc/sudoers` file or add the account to the `sudo` group. A user with `sudo` privileges can execute a superuser-level command by prefacing the command with the `sudo` command. For instance, the command

```
sudo ls /usr/local/secret_directory
```

lists the contents of a secret directory (called `secret_directory`) that might have been off limits to the user without the elevated privileges provided by `sudo`. The `sudo` utility typically prompts you to supply a password to the account that is being granted the temporary privileges. Several Linux systems, including openSUSE, give the account that is created at installation `sudo` privileges.

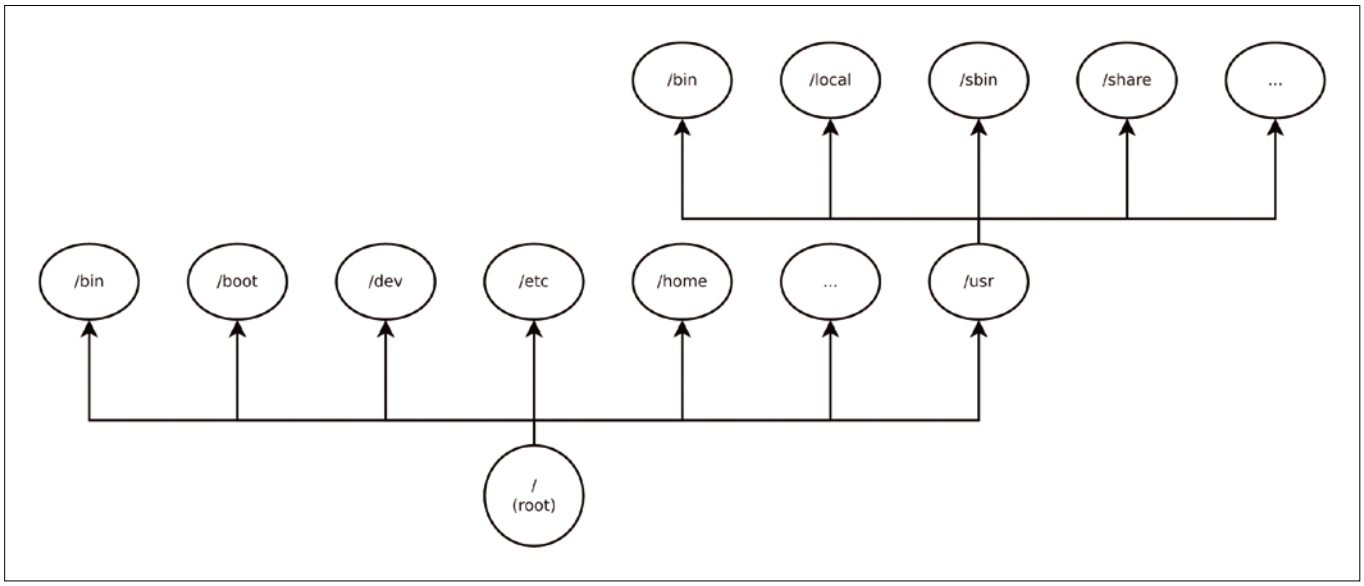


Figure 1: Part of the Linux directory tree.

"misunderstood." The Linux shell (aka, the command line) lets you type commands directly in a terminal window, without having to follow a cursor or click with the mouse. The shell provides a complete set of apps with a wide range of functionalities that could never be stuffed into a graphical program.

To start a terminal window in openSUSE, select *System* in the Application menu and choose *Konsole*.

The filesystem is highly structured in Linux and, although you can navigate it using the desktop's file browser, doing so from the command line is also very convenient. The terminal will open in your home directory. Type `ls` to list the contents of your directory.

You can use the `cd` (change directory) command to move to another directory. You'll also need to mention the path to the target directory:

```
$ cd /home/<your username>/Documents
```

The shell lets you use a dot (.) in the path to represent the current directory. In other words, you could move from the `/home/<your username>` directory to the `Music` subdirectory by typing:

```
$ cd ./Music
```

A double dot means "go back one level in the directory path," so if you want to go from the `/home/<your username>/Music` directory back to your home directory (`/home/<your username>`), you could type:

```
$ cd ..
```

Many systems also use the tilde character (~) to represent the home directory, so no matter where you are, you can always return to your home directory with:

```
$ cd ~
```

TABLE 1: Some Basic Shell Commands

Command	Action
`ls`	List contents of the current directory
`cd`	Change directory
`pwd`	Show current working directory
`mkdir`	Make directory
`cp`	Copy file(s)
`mv`	Move or rename a file or directory
`rm`	Remove file(s)
`rmdir`	Remove directory

If you get lost navigating around in the directory structure, you can always enter the `pwd` (print working directory) command to display the name of the current directory.

To create a new directory, enter the `mkdir` command with the name you want to give to the directory:

```
$ mkdir /home/<your username>/
  Music/Beatles
```

Or, if you were already in the `Music` directory, you could just type:

```
$ mkdir ./Beatles
```

Pro tip: You can make subdirectories recursively with the `-p` option. For example,

```
$ mkdir -p Music/Beatles/Help
```

will create the `Music`, `Beatles`, and `Help` subdirectories all in one go.

The `cp` command lets you copy files (the angle brackets, `<>`, indicate a parameter that you supply):

```
cp <source_filename>
  <destination_filename>
```

The default is to look in the current directory; however, you can include a path with the source or destination to copy to or from a different directory. Of course, you must have the necessary permissions to access the directory. The `mv` instruction moves files or whole directories from one place to another. If the instruction is used on files or directories that are not moving, it renames them. For example,

```
mv file1 dir/
```

will move `file1` into directory `dir/` hanging off the current directory. But

```
mv file1 file2
```

will change `file1`'s name, renaming it `file2`.

To delete a file, use the `rm` (remove) command, and to delete a directory, use `rm -r` or `rmdir`. Needless to say, you must be careful how you use these commands. Table 1 shows a summary of these basic commands. Each of these commands includes additional options that you can enter at the command line, which you can see by typing `man <command>`.

Of course, moving files and traversing the directory structure are not the only things

you can do from the Linux command line. Linux comes with hundreds of command-line utilities that are useful for configuration, troubleshooting, and other common tasks. Online help, wikis, and other documentation sources often reference Linux command-line utilities you'll need to execute specific tasks within Linux.

Users

Linux and other Unix-based systems use the concept of a user account, which allows the system to manage identities and restrict access to a collection of resources associated with a specific person or the groups to which that person belongs. One aspect of a user account is the familiar login prompt that often greets users who want to access a computer. The user's identity is also a means for assigning access permissions to files, directories, and other resources.

Linux also lets the system administrator manage access to resources through group membership. A group is a collection of users, typically with a common purpose and, therefore, a common need for access to a collective set of resources. For example, a group called Accounting might contain users who are part of the accounting team with the need for a common level of access to spreadsheets and other financial data. Rather than manually giving each user permissions for every file, the administrator can assign access permissions to the Accounting group and then place users in the group to give them access to the files.

To see which groups your user belongs to, you can use the command `groups` from the command line.

If more than one user accesses your computer, it is a good idea to create an account for each person. The most common command-line utilities used to create new users and groups are `useradd` and `groupadd`. These utilities live in `/usr/sbin` by default, and to use them, you need to be the superuser.

Privileges

For every file (and directory, device file, etc.), Linux defines which users may read, write, and execute that file. Also, every file belongs to an *owner* (an individual user) and to a *group*. To see the owners, group owners, and permissions for each file and directory in your current directory, type

```
$ ls -l
```

into your terminal window (Figure 2).

The first column on the left shows the permissions, which I will explain shortly; the second column indicates the number of hard links (additional names for a file) to the file or directory; the third column shows the owner; the fourth column shows the group; and the fifth column shows how. Finally, you have the date and time at which the file or directory was created and its name.

If you look at the first column, the following three permissions are assigned separately for owners, groups, and other users:

- Read permission (`r` flag): Users can display the contents of a file or folder on screen, copy the file, and do a few other things. Directories should additionally have the `x` flag (see later) to allow users to change to that folder; otherwise, only a list of files can be displayed.
- Write permission (`w` flag): Users can change files and directories and store their changes. Write permission also includes the ability to delete the file.
- Execute permission (`x` flag): For programs, this means the user is permitted to run the program. Execute permission for a directory means the user is permitted to change to the directory (the user additionally needs read permission to be able to view the folder content).

As you can see, permissions are indicated by the letters `r` (for read), `w` (for write), and `x` (for execute). In the `ls` output, note the three sets of `r`, `w`, and `x` (separated by `-`) at the beginning of the file name entry. The first block shows the permissions for the *owner*, the second block refers to the *group*, and the third block

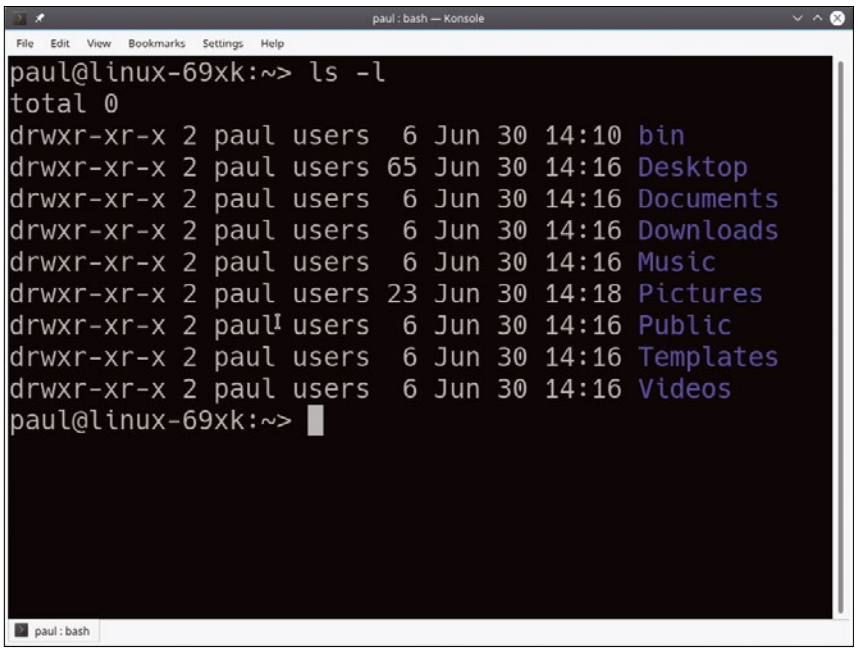


Figure 2: The `ls -l` command shows files' permissions.

refers to *all other users*. Folders are indicated by a `d` (for "directory") and regular files by a single dash (-) at the start of the list. A number of other types of entries exist, such as symlinks, block devices, and character devices, but I will not go into them here.

You'll see a different version of this permission information if you right-click on a file in the Dolphin file manager, choose *Properties*, and then select the *Permissions* tab (Figure 3).

The `chmod` program lets you modify file and directory permissions, assuming you are the owner or the system administrator, using either letters or numbers. Here, I'll concentrate on using letters, because they're easier to remember.

Using letter notation, `u` stands for user (owner), `g` for group, and `o` for others (all other users). I described previously the meanings for `r`, `w`, and `x`. A combination of these letters (without spaces!) with plus, minus, and equals signs tells `chmod` to add, remove, or assign these permissions (Table 1). To give a group read and write permissions for a file, type `chmod g+rw <file>`.

Removing permissions follows the same pattern: The `chmod o-rwx <file>` command removes all permissions for all users who are neither the owner nor members in the owner group. You could combine these two commands:

```
chmod g+rw,o-rwx file_name
```

As I mentioned before, an equals sign lets you assign precisely the permissions specified at the command line. For example, the command

```
chmod ugo=rwx directory_name
```

gives the owner, group members, and all other users read, write, and execute permissions for the directory. Instead of `ugo`, you could alternatively use `a` (for "all") to assign user, group, and other permissions.

To change group membership for files and directories, you can use the `chgrp` tool. Keep in mind that Linux takes extra precautions with this command: As a "normal" user, you are allowed to assign your own files to specific groups as long as you are a member of the group.

To see the groups to which your current user belongs, you can type `groups` into a terminal window:

```
$ groups
editors adm dialout cdrom sudo ➥
  audio video plugdev games users ➥
  netdev input indiecity
```

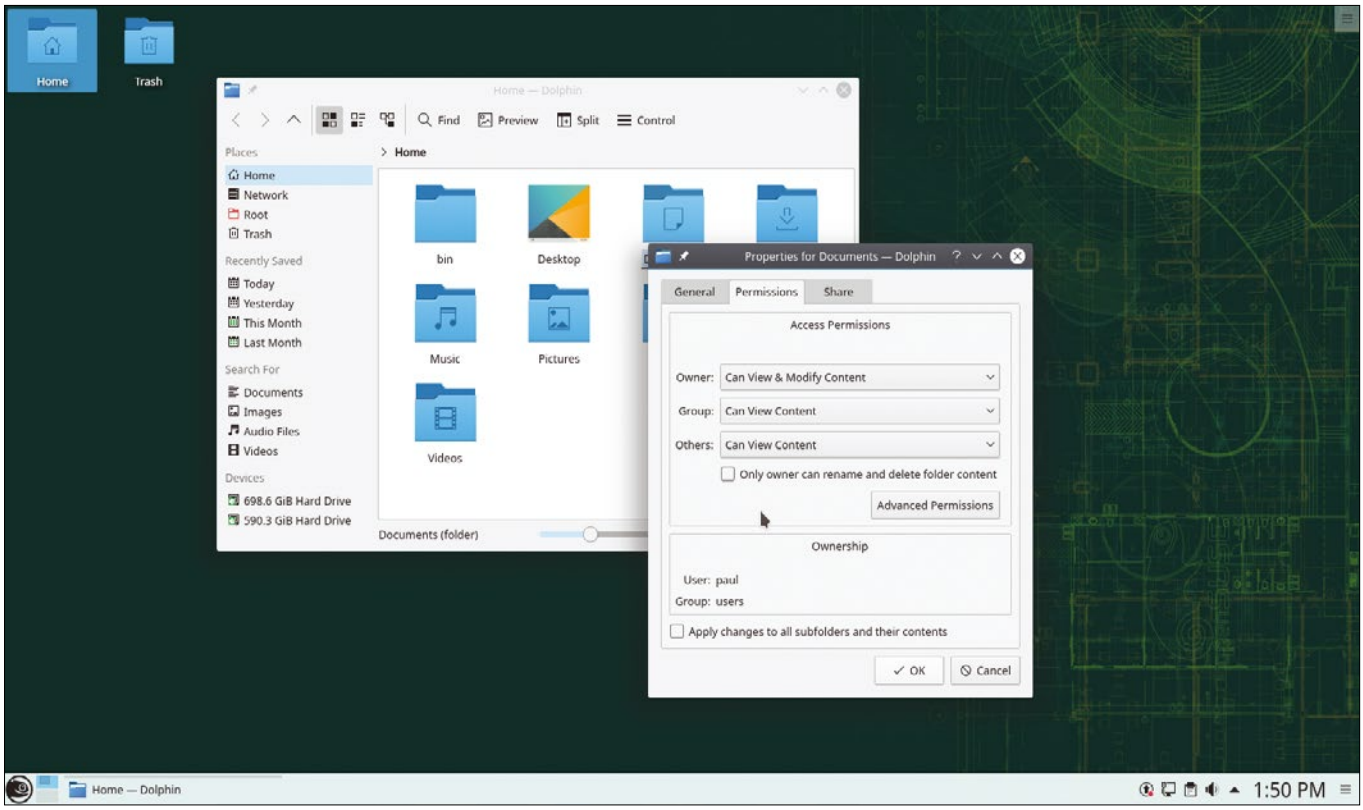


Figure 3: You can see the permissions for a file or directory by right-clicking on it and choosing ***Properties*** from the file browser and then selecting the ***Permissions*** tab.

Rights of Ownership

The `chown` utility is primarily for the root user, but a "normal" user may use the tool in some situations. For example, `chown phil:audio file_name` changes the group membership of the file. The user `phil` is allowed to use this command if the user is a member of the group `audio` and owns the named file.

Listing 1: Oops ... Locked Out!

```
$ ls -l test
total 0
-rwxr-xr-x 1 audio audio 0 Nov 4 12:12 bar
-rwxr-xr-x 1 audio audio 0 Nov 4 12:12 foo
$ chmod -R a-x test
chmod: cannot access 'test/bar': Permission
       denied
chmod: cannot access 'test/foo': Permission
       denied
```

Listing 2: Using the find Command

```
$ find test -type f -exec chmod a-x \{\} +
$ ls -l test
total 0
-rw-r--r-- 1 audio audio 0 Nov 4 12:12 bar
-rw-r--r-- 1 audio audio 0 Nov 4 12:12 foo
```

In this case, the user may change access to their own files for members of the groups `editors`, `adm`, `dialout`, `cdrom`, `sudo`, `audio`, and so on. The `chgrp` command first expects information about the new group and then the name of the file or directory. To assign a file to the `audio` group, just type:

```
chgrp audio file_name
```

On a Linux system, the system administrator is allowed to assign new owners and new groups to files and directories. To give a file to user `phil`, simply use the `chown` command:

```
chown phil file_name
```

Also, you can define a new group in the same command. To do so, add the name of the group after a colon:

```
chown phil:audio file_name
```

The file now belongs to user `phil` and group `audio` (see the "Rights of Ownership" box).

All three tools – `chmod`, `chgrp`, and `chown` – support the `-R` option for recursive actions. If you want members of the video group to access a directory and the files it contains, just type:

```
chgrp -R video <directory>
```

The `-R` option can also save you some typing in combination with the `chmod` command. To remove read, write, and execute permissions from this folder for all users who are not the owner or members of the video group, type:

```
chmod -R o-rwx <directory>
```

Be careful when you run recursive commands that remove the execute flag. If you mistakenly `type a-x` instead of `o-x`, you will lock yourself out: `chmod` will remove execute permissions from the parent directory and your ability to make changes to the directory or modify the files (Listing 1).

Using the `find` command can help you avoid this kind of dilemma (Listing 2). The `find` command in Listing 2 first discovers files (`-type f`) in the test directory (and possible subfolders) and then runs `chmod` against them, ignoring the directory itself.

Conclusion

Linux is a vast system consisting of thousands of files and hundreds of programs. This brief introduction to Linux fundamentals isn't intended to answer all your questions, but it should provide you with some basic concepts you'll need, to work with Linux commands and understand Linux user accounts, privileges, and file permissions. For information on installing software from the command line, check out the "Installing Packages with zypper" box. ■

THE AUTHOR

Paul Brown has been writing about technology professionally since 1996, when he got his first break writing a monthly column for the Spanish tech underground magazine ARROBA. Since then, he has written extensively about Internet fads, creative programming, and fancy gadgets, as well as free software and free hardware. He has edited Ubuntu User magazine both in Spanish and English, Raspberry Pi Geek (in English), and the Spanish edition of Linux Magazine. He currently writes for Linux Magazine and Linux.com, and he acts as a Communications Officer for Free Software organizations such as KDE e.V. and Free Software Foundation Europe.

INSTALLING PACKAGES WITH ZYPPER

Modern Linux distros transmit software in the form of *packages*. A package contains the application you want to install, plus additional information about other packages (called *dependencies*) necessary to use the application. Packages are stored on servers called *package repositories* located on the Internet or on a local network.

To install a new application, enter the name of the application in the local package manager. The package manager connects to the server, downloads the package, and installs the package on your system.

The YaST management interface lets you install packages in an easy GUI environment. (See the article on YaST elsewhere in this issue.) However, many users prefer to install and update software from the command line. OpenSUSE provides the `zypper` command-line tool as an alternative to YaST.

Installing software on the system typically requires superuser privileges. OpenSUSE has a superuser terminal window that lets you execute all commands as root. Click the application launcher (Start menu) and choose *System | Terminal – Super User Mode*. You'll need to enter the root password.

An alternative is to work from an ordinary terminal window (click the application launcher and select *System | Konsole*) and preface the command with `sudo`, as described elsewhere in this article.

The command

```
zypper search package_name
```

checks for a package called *package_name*.

To install a package, type:

```
zypper install package_name
```

You can later delete the package using the command:

```
zypper remove package_name
```

To reinstall a previously installed package, use the `-f` option:

```
zypper install -f package_name
```

You can also use `zypper` to install system updates. To display packages for which an update is pending, enter:

```
zypper list-updates
```

If you opt for an update of a single package, the command is:

```
zypper update package_name
```

To update all installed packages with newer available versions, enter:

```
zypper update
```

Security updates and bug fixes often take the form of *patches*. A patch typically is not a full version update but is more like a repair to an existing version. To install patches, enter:

```
zypper patch
```

Marcel Hilzinger

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Music and video on openSUSE

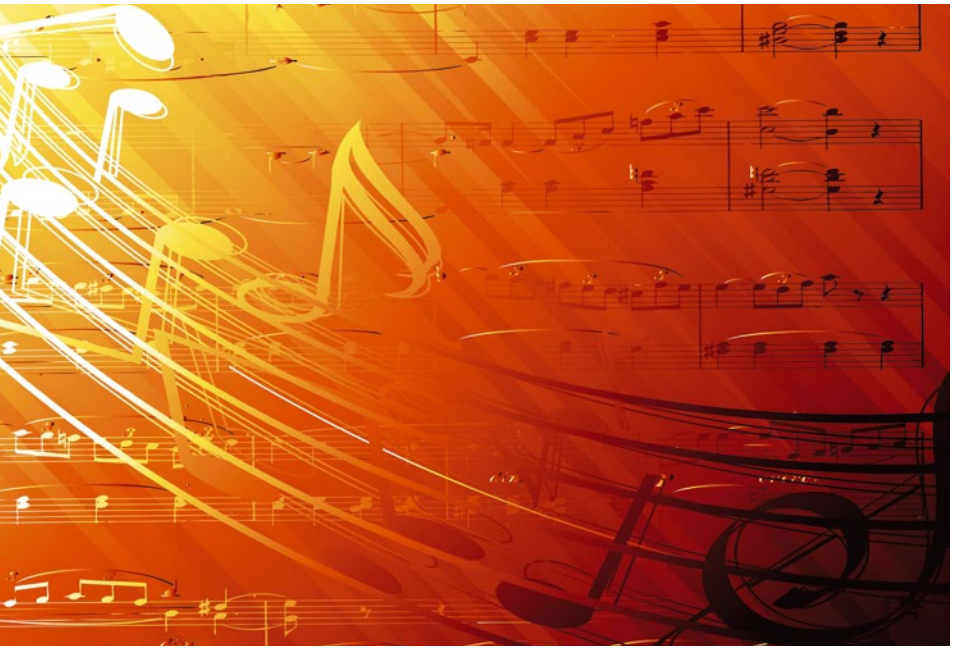
Sound of Music

Watch videos, play music, and stream Internet radio stations on openSUSE. *By Dmitri Popov*

Any modern Linux distribution worth its salt lets you listen to music, watch videos, and stream online content, and openSUSE is no exception. This distro comes with everything you need to tend to your multimedia needs.

A Small Matter of Codecs

Before you start enjoying your favorite music tracks or watch kitten videos on openSUSE, there is one important thing you need to do. OpenSUSE ships without any patented and proprietary codecs. While there are plenty of arguments for and against this approach, the bottom line is that the distro can't handle some proprietary formats out of the box. Fortunately, there is a simple fix for that. The openSUSE Community website offers 1-Click installers for installing the missing codecs with a minimum of effort [1]. Simply click on the 1-Click installer button for your desktop environment. When prompted, choose *Open with*, make sure the *YaST 1-Click Install* item is selected in the drop-down list, and press *OK* (Figure 1). Then, follow the provided instructions and press *Finish* when the installation is completed.



Dragon Player

Dragon Player, the default application for watching videos on openSUSE, is decidedly no-frills – which is a good thing if you want to play video files and DVDs with a minimum of fuss. Although it's not exactly overloaded with features, this simple application does have a couple of clever tricks up its sleeve. In addition to local files, Dragon Player can handle streams, so you can use it to listen to your favorite Internet radio stations (Figure 2). Press the *Play Stream* button in the left sidebar, enter the URL of the desired stream, and press *OK*; Dragon Player should start playing the stream. If you need to tweak the quality of the video you are watching, Dragon Player allows you to do just that. Choose *Settings* | *Video Settings* to activate the video settings sidebar. You can then adjust the brightness, contrast, hue, and saturation settings.

VLC Media Player

Although Dragon Player does a decent job of playing media files and streams, you'll

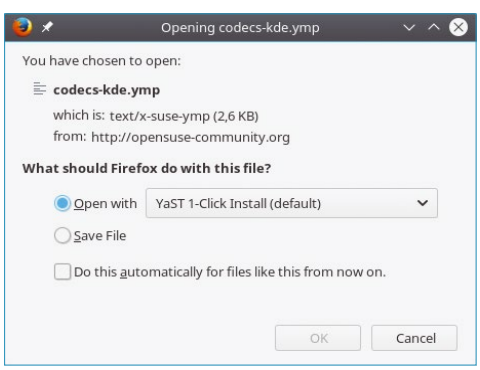


Figure 1: Installing proprietary codecs on openSUSE is a matter of a few mouse clicks.

Lead Image © Kundra, fotolia.com

sooner or later outgrow it, and when this time comes, VLC is ready to step in. To call VLC a media player would be an understatement, because this application offers a veritable cornucopia of useful tools and features. The version available in the official openSUSE software repositories is stripped of all proprietary codecs, so it's not particularly useful for most multimedia-related tasks, but if you installed additional codecs as described earlier, you already have the PackMan repositories that have a fully-loaded version of VLC. The easiest way to install it is to use the YaST tool. Launch YaST, and start the *Software Management* module (Figure 3). In the *Search* field, type *vlc* and press *Search*. Click the checkbox next to the *vlc* package to mark it for installation. Next, switch to the *Versions* section and select the version from the PackMan repository (the one that has the *http://packman.links2linux.de* URL in its name). Do the same for the *vlc-codecs* package, then press *Accept* to install the selected packages and their dependencies.

Although it features a deceptively simple interface, VLC is far from a bare-bones application. This excellent media player has a slew of clever tricks.

Like any competent player software, VLC supports skins, so you can easily customize its appearance by installing additional skin packages. VLC's official website offers a few ready-made skins for you to try [2]. To install a skin, download its *.vlt* file, launch VLC, and choose *Tools | Preferences* (or press Ctrl + P). In the *Interface* section, enable the *Use custom skin* option and select the downloaded *.vlt* file. Press *Save* and restart VLC (Figure 4).

In most situations, VLC's basic interface is adequate for controlling the application, but if you want to tweak the video or audio settings, you can do this by pressing the *Show extended settings* button in the main toolbar (Figure 5). Under the *Video Effects* tab, you can adjust different video settings such as Contrast, Brightness, and Saturation. This can come in particularly useful when you want to tweak poor-quality videos. In the *Audio Effects* section, you can enable the Equalizer and then choose one of the ready-made presets or adjust each channel manually.

VLC's playlist interface (it can be toggled using Ctrl + L) has a couple of clever features of its own. The *Local Network* section, for example, lets you find media served on the local network via the Universal Plug and Play (UPnP) and Bonjour services, whereas the *Internet | Icecast Radio Directory* section displays a comprehensive list of radio stations you can stream directly in VLC. Want to use VLC as a no-frills podcast player? Press the *Subscribe to a pod-*

Figure 2: You can use the Dragon Player multimedia player to stream Internet radio.

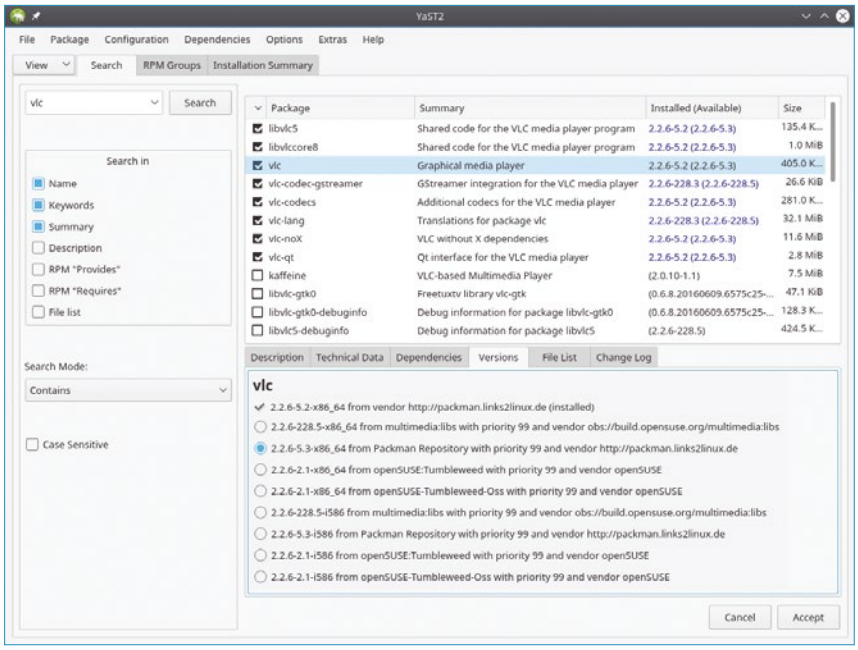


Figure 3: Use the PackMan repository to install a fully loaded version of VLC.

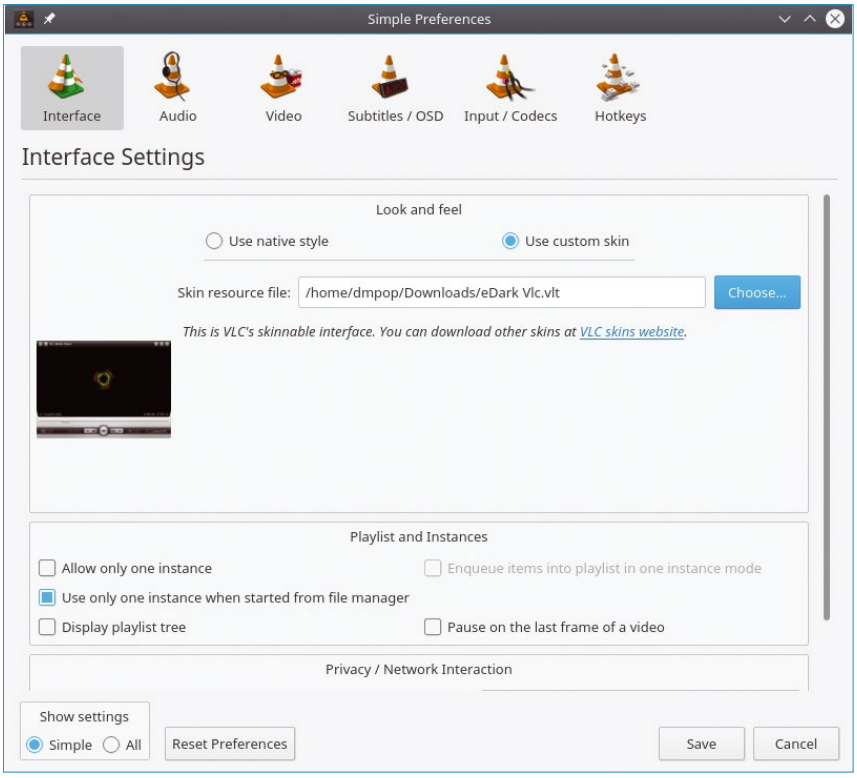


Figure 4: Installing a VLC skin.

cast button next to the *Internet* | *Podcasts* item, specify the podcast's URL, and hit *OK*. This will add a new podcast to the list and fetch the available episodes (Figure 6).

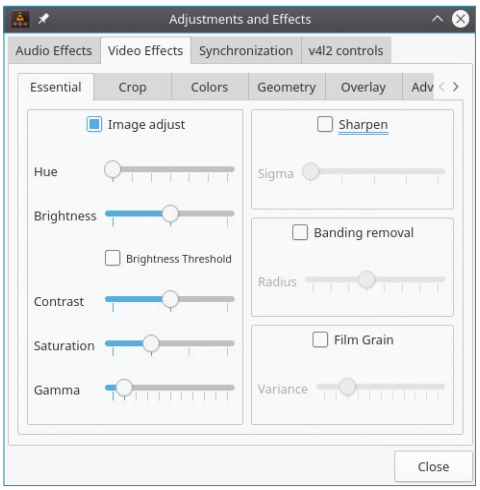


Figure 5: The extended settings control panel allows you to tweak video options.

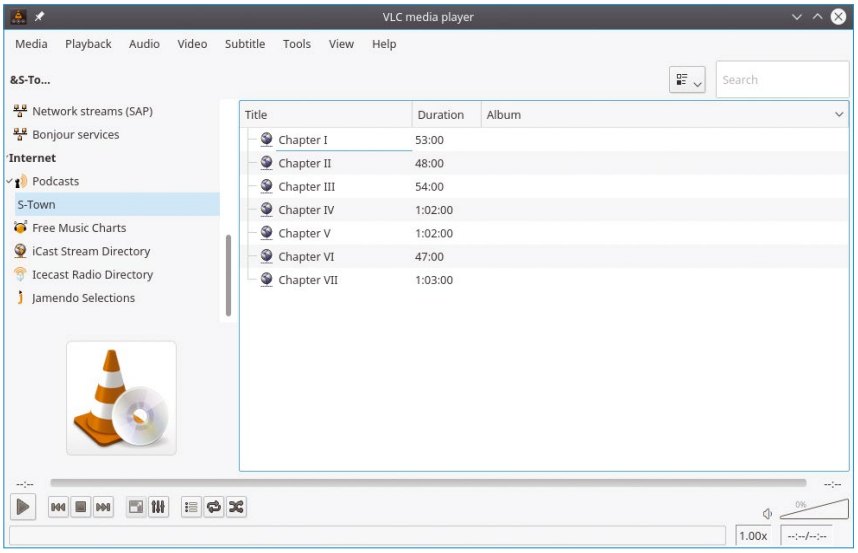


Figure 6: You can use VLC to subscribe and listen to podcasts.

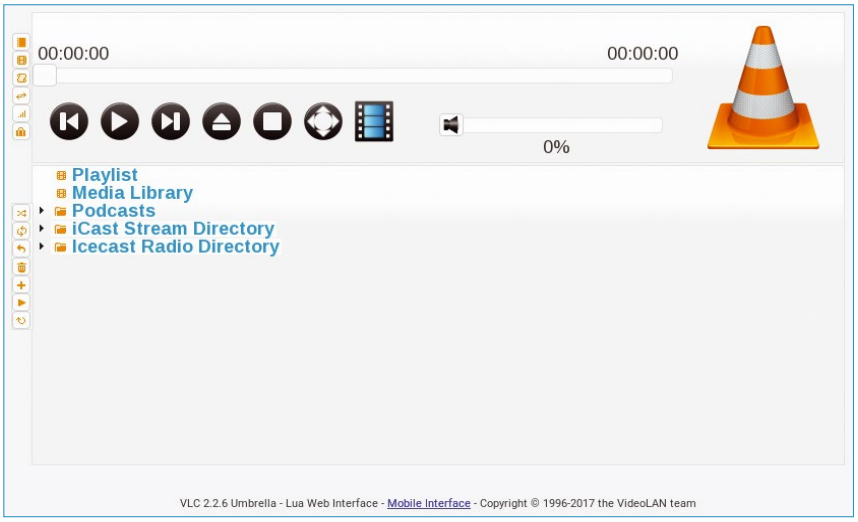


Figure 7: VLC features a built-in web interface.

VLC comes with a built-in web interface, so you can use and control the player from any machine with a browser. However, the web interface is not enabled and configured by default. To activate it, choose *View* | *Add Interface* | *Web*. You also need to specify a password; otherwise, you can't access the web interface. Choose *Tools* | *Preferences* and enable the *All* option in the *Show settings* area. Switch then to the *Interfaces* | *Main Interfaces* | *Lua* section and specify the desired password in the *Lua HTTP* area. Restart VLC, point your browser to *http://<vlc>:8080* (replace *<vlc>* with the actual IP address or domain name of the machine running VLC), log in using the specified password (leave the username field empty), and you should see VLC's web interface in all its beauty (Figure 7).

Need to take a snapshot of the currently playing video? Use the *Take Snapshot* command under the Video menu. Before you do this, though, you should configure the snapshot options. Choose *Tools* | *Preferences*, switch to the *Video* section, and specify the snapshot directory and format, as well as other settings.

VLC is not limited to playing and streaming media: It can also convert video and audio between different formats. This functionality can be useful in many situations. Say you want to save a YouTube video locally, so you can watch it later or when you are offline. Launch VLC and choose *Media* | *Convert/Save* (or press Ctrl + R). Switch to the *Network* section, provide the URL of the YouTube video you want to save, and press *Convert/Save*. This opens the Convert dialog, where you can configure conversion settings (Figure 8). Although you can select one of the ready-made conversion profiles or create your own, the default *Video-H.264 + MP3 (MP4)* preset should do the trick. Specify a location and name for the resulting file and press *Start*. In a similar manner, you can use VLC to record and save an audio stream. Follow the above steps, but instead of the link to a video, specify the URL of the stream you want to record. Also, select the desired audio profile in the Convert dialog.

Amarok

Although both Dragon Player and VLC can be used to play music, they are no match for Amarok. This advanced player offers practically every feature imaginable for playing and organizing music tracks and streaming audio content (Figure 9). Amarok's interface is an acquired taste, but once you master it, you'll appreciate its power and flexibility.

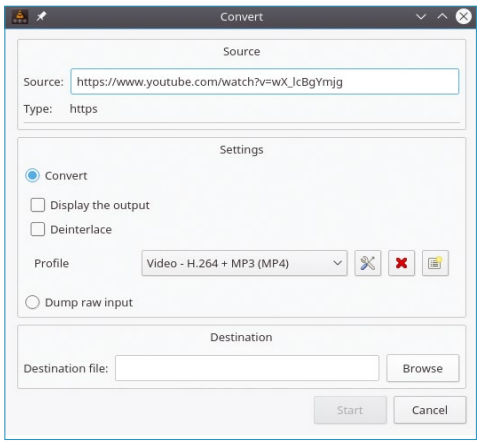


Figure 8: VLC can be used to transcode and save online audio and video streams.

When you launch Amarok for the first time, you might want to point it to the folders on your machine containing music files. To do this, choose *Settings* | *Configure Amarok*, switch to the *Local Collection* section, and mark the directories containing music files. Make sure that the *Scan folders recursively* and *Watch folders for changes* options are enabled. This way, Amarok will monitor the specified folders and subfolders and automatically keep your music collection up-to-date. When you save the changes and switch to the *Local Music* section in the left pane of Amarok's main window, you should see all your music files.

The clever part is that you don't have to organize your music library; Amarok does this for you. Basically, you can throw all your music files into a folder and point Amarok to it, and the application will neatly organize your music by artist, year, and album. Amarok does this without making any changes to the original directory structure or file names. You can also let the application organize your music files on the hard disk and transcode them, if needed. To do this, switch to the *Local Collection* section, right-click on the *Local Collection* header, and choose *Organize Files*. In the *Transcode Tracks* window, choose the desired format and configure the available transcoding settings (you can skip this step if you don't want to transcode the files). Press *Move* to open the Organize Tracks dialog, where you can define a rule for organizing tracks. The default rule moves and groups the tracks using the *artist/album/track number-title* rule, but you can easily define your own rule by dragging and dropping the available elements onto the rule area and arranging them in the desired order (Figure 10). Once the

Figure 9: Amarok caters to all your music playing needs.

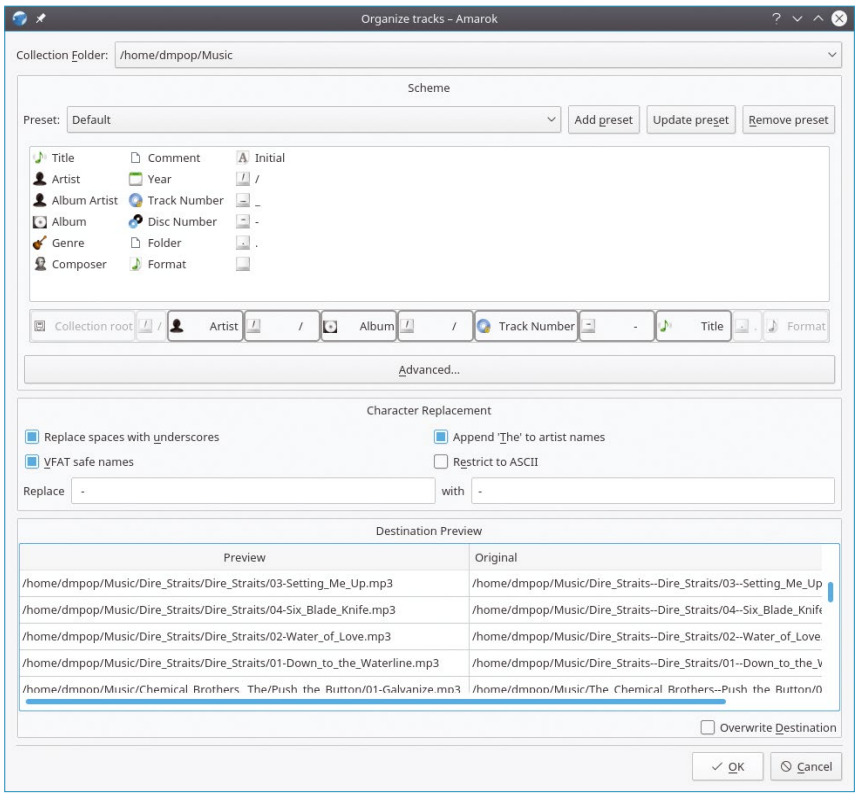


Figure 10: Amarok can organize your music tracks for you.

rule is ready, press *OK* to let Amarok organize your music files.

As you would expect, Amarok supports playlists. The right sidebar shows the current playlist, and you can add tracks there by simply dragging individual tracks and entire albums onto it from the left sidebar. To save the playlist, press the *Save Current Playlist* button. You can then access the created playlist in the *Playlists* | *Saved Playlists* section. Here, you'll also find another nifty tool: Automated Playlist Generator. As the name suggests, this tool makes it possible to create playlists based on user-defined presets. The generator comes with a few ready-made presets, and you can easily create your own. For example, you can create a preset for generating a playlist containing tracks with a five-star rating only. To do this, press the *Add new preset* button and double-click on the new preset to open it for editing. Press *Add New* and select *Match tags*. From the *Field* drop-down list, select *rating*, and configure the preset as shown in Figure 11. Give the preset a descriptive name and save the changes by pressing *OK*. Amarok also supports so-called dynamic playlists that work like the Automatic Playlist Generator, allowing you to create playlists on the fly on the basis of specific criteria.

The *Internet* section in the left sidebar gives you access to several sources for buying and downloading music. If you have an Amazon account, you can buy music from the MP3 Music Store without leaving the convenience of Amarok. This store is only available in selected countries, though. If your country is not on the list, you have other options in Amarok, too. The Magnatune store, for example, lets you stream tracks from their catalog (as a member, you can also download music tracks), and Jamendo gives you access to their vast library of music tracks released under the Creative Commons license. Want to use Amarok to subscribe and listen to podcasts? You can quickly subscribe to one of the podcasts in the *Internet* | *Podcast Directory* section. If you are into audio books, you can use Amarok to search and fetch free audio books from LibriVox [3].

In addition to the described functionality, Amarok sports a large number of creature comforts. When playing a music track, Amarok conveniently shows a Wikipedia article about the artist and the song's lyrics. If you mistakenly added duplicate tracks to a playlist, you can prune it using the *Tools* | *Remove Duplicates* command. You can extend Amarok's default functionality and add other streaming services via scripts. Choose *Tools* | *Configure Amarok*, switch to the *Scripts* section, press *Manage Scripts*, and install the scripts you like.

Info

[1] openSUSE 1-Click codec installers: *opensuse-community.org*

[2] VLC skins: *www.videolan.org/vlc/skins.php*

[3] LibreVox: *https://librivox.org*

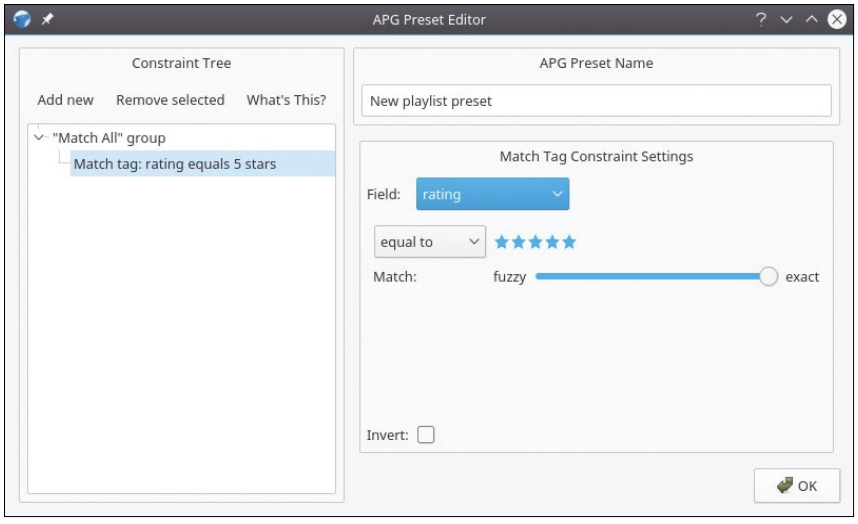


Figure 11: Creating a new Automatic Playlist Generator preset.

Wrap Up

If you want to watch DVDs, stream Internet radio stations, save YouTube videos, and listen to podcasts, openSUSE has got you covered. You do need to enable support for proprietary formats in openSUSE, but once you've done that, openSUSE can handle any multimedia task you throw at it. ■

Backing up your data with Déjà Dup

Copies

The simplicity of Déjà Dup will have you backing up your data without delay.

By Rita L Sooby

No single computer is 100 percent safe. Hardware failures, virus infections, and even theft can happen, no matter how careful you are. If you want to reduce the risk of being left in the lurch because you lost your data, files, and pictures, you should back up your machine regularly.

Many people consider backup capabilities a fundamental part of an operating system, and Linux offers a number of solutions, although many are designed to be run at the command line only. Déjà Dup [1] is a nice, easy-to-use graphical application that hides the complexity of the `duplicity` command-line utility [2] to provide incremental backups.

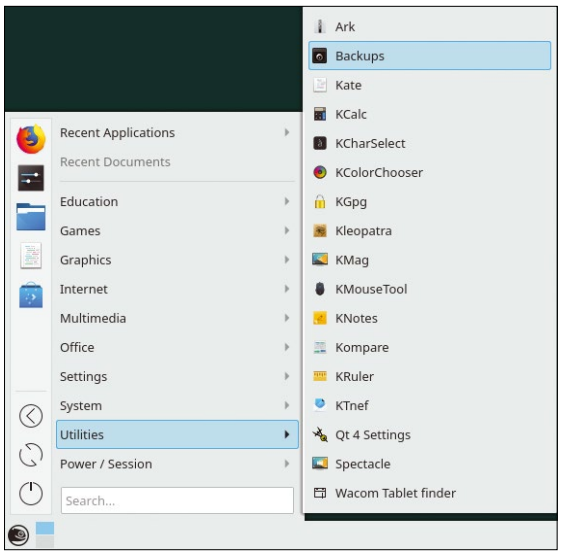


Figure 1: Running Déjà Dup from the Start menu.

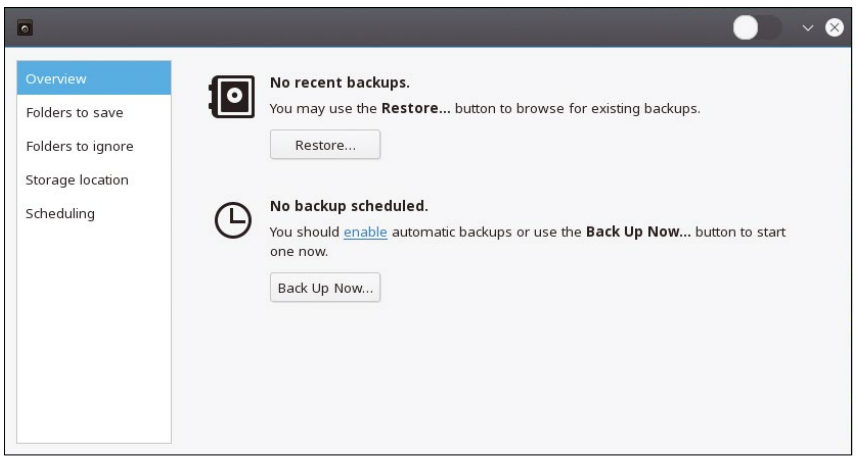


Figure 2: Déjà Dup fires up, ready to accept instructions for your first backup.

Installation

To begin, you will have to install the *deja-dup* package in YaST. No worries, you can refer to the article about YaST in this special issue that explains how to install packages. YaST takes care of installing *deja-dup* and all its dependencies.

First Start

As soon as the installation is finished, you can start Déjà Dup from your KDE desktop menu by clicking on the menu icon in the lower left-hand corner and choosing *Utilities | Backups* (Figure 1). On startup, Déjà Dup displays default settings, which you can keep or change (Figure 2).

Configuration

Make sure to double-check every option in Déjà Dup, because depending on the installation or your personal preferences, you probably will want to change some of the defaults. For example, one default setting that makes sense is to skip the *Trash* folder when making a backup. On the other hand, the *~/Downloads* folder also is listed in the *Folders to ignore* tab. Depending on how you use this folder, though, you might not want to ignore it during a backup.

Déjà Dup is most powerful when it comes to the options that specify where you will store your backups. The tool provides a number of choices in the *Storage location* tab (Figure 3). For example, you can store

your backed up data on a *Network Server* (Figure 4) or on popular Internet and cloud services like *Google* Drive, and *Nextcloud*. Even though it is not the safest option, you can even choose to store a backup on your computer in a *Local Folder*.

Last, but not least, you can have Déjà Dup perform backups regularly and automatically. If you use your Linux computer on a daily basis, it makes sense to make a backup every day, but weekly backups are recommended at the very least (Figure 5). You can also decide whether your backup should be stored for six months, a year, or forever.

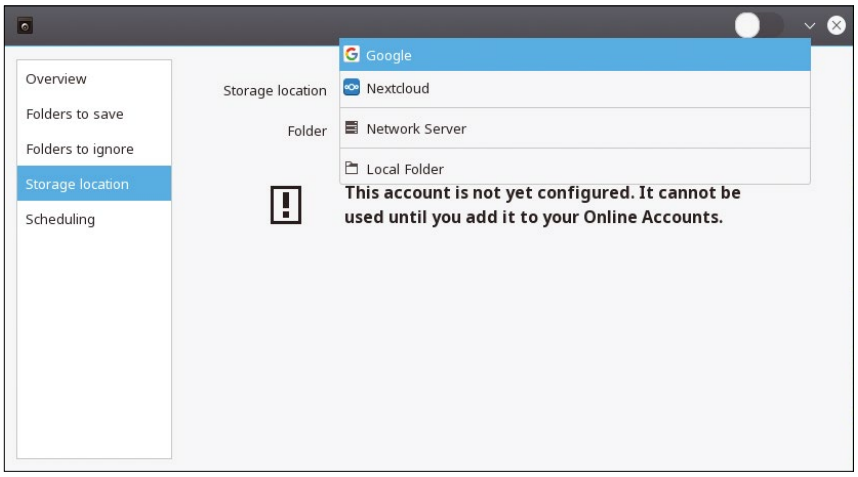


Figure 3: You have many possibilities when deciding where to store your backups.

Performing a Backup

Now that your preferences are set up, you can create an immediate backup by returning to the *Overview* tab and clicking the *Back Up Now* button. Déjà Dup will ask whether you want to encrypt the backup file with a password (Figure 6). If you plan to upload your backup files to a cloud storage provider, you should definitely use this feature to ensure even better protection of your data.

Conclusion

Déjà Dup presents a simple interface that even beginners can navigate to keep their data safe and secure. ■

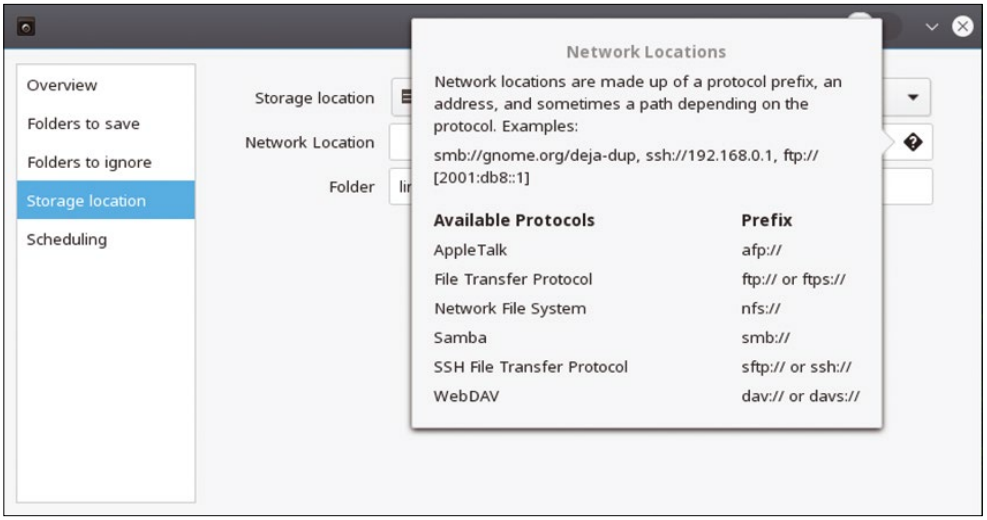


Figure 4: Déjà Dup shows you how to access various network locations.

INFO

[1] Déjà Dup: *https://software.opensuse.org/package/deja-dup*

[2] duplicity: *http://duplicity.nongnu.org/docs.html*

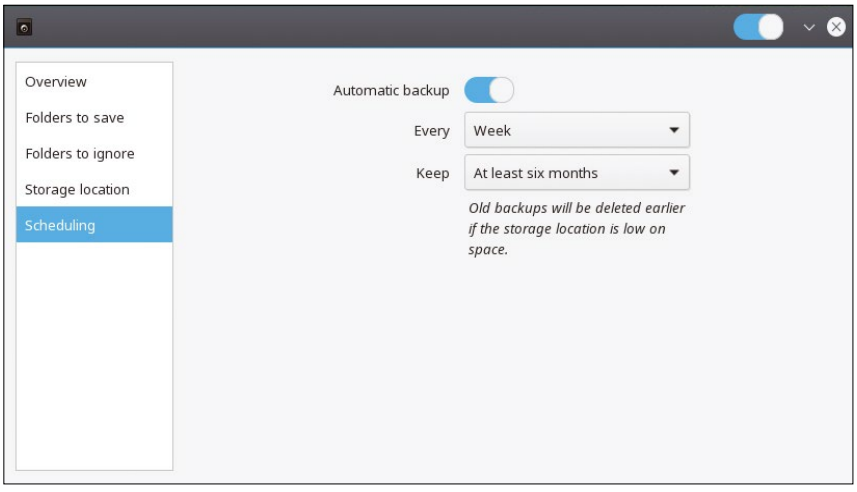


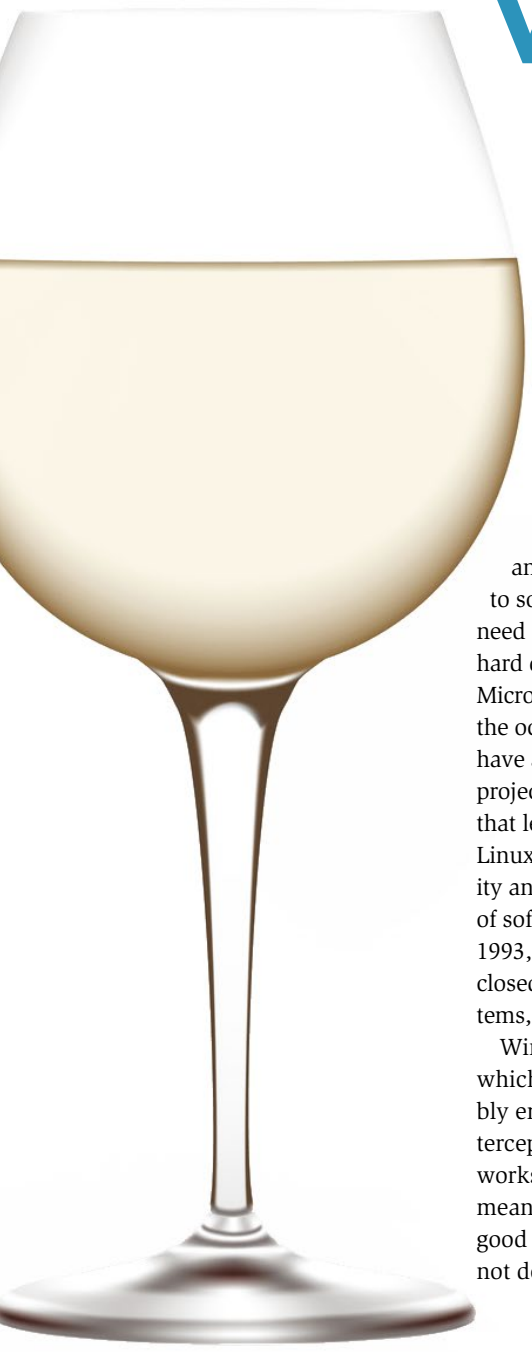
Figure 5: Scheduling recurring backups is easy.

Figure 6: You should protect your backup with a password, especially if you are saving it to a network or cloud storage.

Running Windows apps on Linux

Freedom with Wine

Free your home, office, and friends of Microsoft with our tips and tricks. *By Mike Saunders*



While those of us dedicated to free and open source software (FOSS) love to shout from the rooftops about the awesomeness of GNU, Linux, and open standards, we also have to deal with the awkward reality that Windows is still very common on the desktop and has an enormous software base. Sure, FOSS equivalents for proprietary Windows apps exist (and new ones are popping up every week), but certain tools simply don't exist elsewhere, and people or companies that want to migrate away from Windows toward Linux might still need to run the occasional Windows program or game.

Of course, dual-booting (having Linux and Windows on the same PC) is one way to solve this problem, but it still means you need a Windows license and a chunk of your hard drive devoted to it. If you want to be as Microsoft-free as possible but still need to run the occasional Windows app or game, you have another option: Wine. This open source project provides a software compatibility layer that lets you run many Windows programs on Linux – albeit with varying degrees of reliability and compatibility. Wine is a mature piece of software, having been in development since 1993, but given the vast complexity (and closed nature) of Microsoft's operating systems, it has trouble running some apps.

Wine means "Wine Is Not an Emulator" – which seems silly for something that ostensibly emulates Windows. But really, Wine intercepts system calls from programs and reworks them for their Linux equivalents. This means that you can often get surprisingly good performance from Wine, because it's not doing the job of emulating a whole CPU. Indeed, I've heard from readers who say that some Windows apps run faster on Linux plus Wine than on native Windows itself!

Over the next few pages, I'll show you how to install and configure Wine, exploring some of its workings and a few tricks to save time. If you've got some old Windows games you'd like to dig out, now's the time! Or indeed, even if you're fully Microsoft-free, it's worth knowing the essentials of using Wine in case you need to help a friend or school/club/charity/company transition to Linux while still maintaining some Windows compatibility.

First Steps

Wine isn't included in openSUSE by default, but you can install it very quickly. Just open a terminal from your program menu, and enter

```
sudo zypper in wine
```

to get it installed. If you're fairly new to Linux and not yet fully familiar with the command line, or you have problems with the command, you can also find Wine by searching in your graphical package manager (*System | Install/Remove Software*) (Figure 1), but bear in mind that you'll be using the command line for a few things in this tutorial.

Note that Wine is updated regularly by its developers, so if you have problems running a particular Windows program, it may be worth updating to the very latest version of Wine because compatibility improves with every release. On the download page [1], you'll find binary packages for various distros. The WineHQ wiki also shows you how to build it from source [2]. Just make sure you remove any Wine binary packages before compiling the source code to avoid conflicts on your system.

Once you have Wine installed, it's a good idea to test it with a small and fairly simple program to make sure it's working correctly before moving on to more complicated apps. Here, I'll use a clone of Minesweeper (a popular Windows game) called Minez. To begin, download the latest version (`minez0.1.2.zip` at the time of writing) [3], extract the archive, and run the game:

```
cd Downloads
unzip minez0.1.2.zip
cd minez
wine minez.exe
```

If this is the first time you're using Wine, a new configuration will be created – more on that in a moment – but all being well, the Minez game will appear on your screen and should be playable (Figure 2). There you have it, a native Windows app running flawlessly on Linux!

Working with Installers

Very few Windows programs are available as simple standalone *.exe* files, however; most of them require some kind of installation. For this example, you'll be using the Windows version of AbiWord [4]. Grab the `abiword-setup-2.9.4.exe` file and run it in Wine:

```
wine abiword-setup-2.9.4.exe
```

This time, a familiar installation wizard will pop up, asking a few questions. To skip through them, just keep tapping Enter. Once the files have been copied over, choose not to run AbiWord immediately, and the installer window closes. OK, what now? How do you run the freshly installed AbiWord from here?

Well, the first time you ran Wine it created a minimal installation of a Windows-like operating system (including libraries and tools) inside `.wine/drive_c/` in your home directory. Have a look inside there, and notice the famous `Program Files` and `Windows` directories. After doing a bit of searching, you will find that the AbiWord executable has been installed inside `Program Files (x86)/AbiWord/bin`, so you can run it with:

```
wine "Program Files (x86)"➥
  /AbiWord/bin/AbiWord.exe
```

Note the use of quotation marks here to deal with the spaces and parentheses, which are usually annoying to handle at the command line. Voila, AbiWord appears as expected, and you could create a desktop or menu

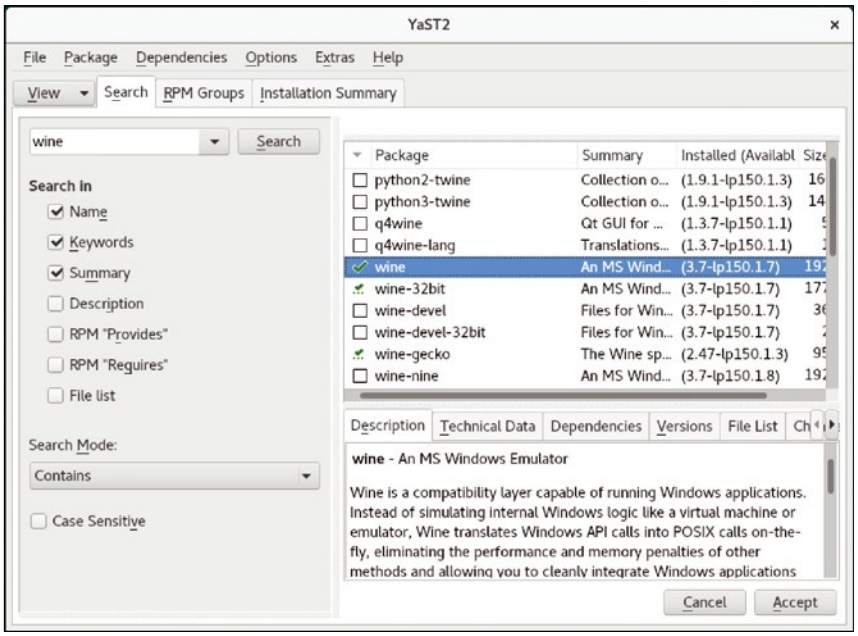


Figure 1: You can find Wine in openSUSE's package manager.

shortcut to run the above command (including the full path `/home/user/.wine/drive_c`) to save always having to type it.

Bear in mind that because Wine is not an emulator, programs running inside it are not sandboxed away from the rest of the system. They can access files in your home directory like any other native Linux app, so you still have to be aware of security issues, even if a lot of viruses and malware wouldn't have the same effect as on a native Windows system.

You can see this for yourself: In AbiWord, go to *File* | *Open* and navigate to *My Computer*. You'll see that the `C:` drive is mapped to `.wine/drive_c/` in your home directory, whereas `Z:` is mapped to the root (`/`) directory (Figure 3). In many cases, this is useful, because you can access other files on your filesystem without having to copy them into a dedicated place. However, if you want to run something potentially risky, it's better to do it in a virtual machine.

A last note on installers: Many Windows programs are now supplied in `.msi` format, for which you'll need the `msiexec` utility (included with Wine) followed by the `/i` parameter and the package file name to install:

```
msiexec /i <program>.msi
```

You can then locate the program inside the `drive_c` directory.

Advanced Features

At this point, you can start trying to install your favorite old Windows programs and

Figure 2: Once you have this small and simple Minesweeper clone running, you know Wine is installed properly.

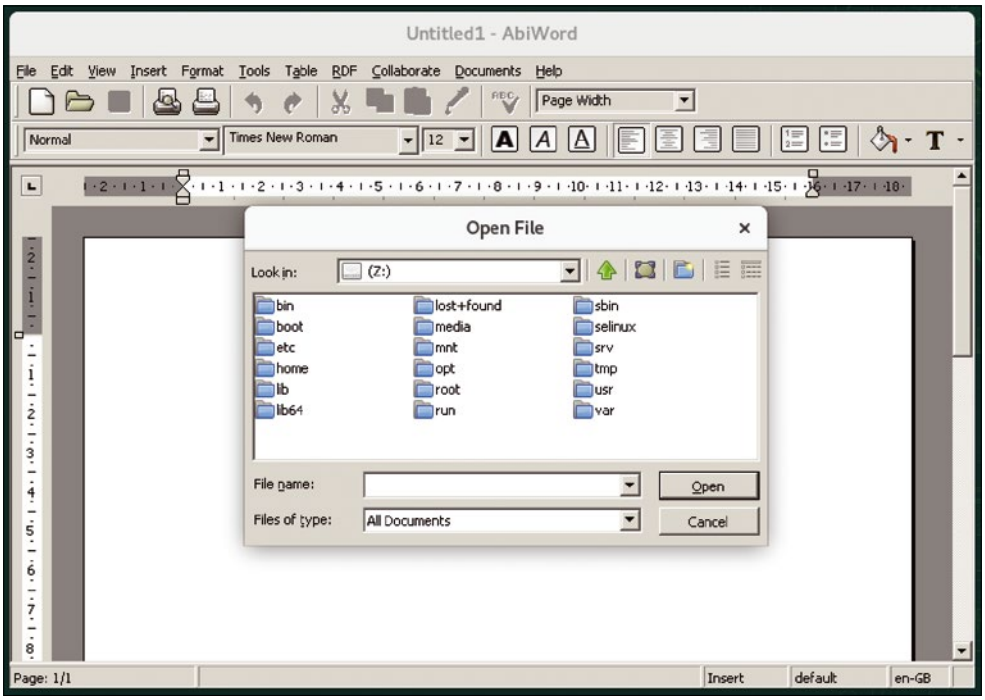


Figure 3: By default, Wine maps the virtual `Z:` drive to your root filesystem – so bear in mind that Windows apps can still see your Linux files!

games, but chances are you'll have some problems. Wine is far from perfect (see the "Chasing a Moving Target" box for reasons why), but it's also highly configurable; you have so many settings to tweak to coax (one hopes!) some programs into running.

Enter `winecfg` to start Wine's graphical setup tool and look at the tabs along the top (Figure 4). Of special interest for compatibility is *Applications*, which should contain a list of programs you've installed in Wine. (If not, click *Add Application* and locate them.) In the drop-down list at the bottom, you can choose which version of Windows should be imitated for each app.

Another tab worth looking at is *Libraries*. Wine ships with a number of DLL files that provide much of the functionality of Windows' own libraries, but with some limitations and bugs. In many cases, you can improve compatibility by using real Windows DLLs – provided you have a legitimate copy of Windows, of course.

To see where Wine places these libraries, go into `~/.wine/drive_c/windows` and then the `system32` or `syswow64` directories. Enter `ls` at the command line, and you'll see lots of DLLs created by the Wine team. If you want to use a native library, it's best to place the native DLL alongside the EXE file of the

CHASING A MOVING TARGET

Given that Wine has been in development for 23 years, you might wonder why it still has issues running some Windows programs. After all, that must be enough time to recreate the Windows API, right? Especially when the project has benefited from commercial backing? Well, there are two main reasons why compatibility is still not perfect.

First, a lot of the Windows internals are not documented – at least, not publicly. Details for many API calls are thin on the ground, and Microsoft hasn't been particularly forthcoming with them. Yes, there have been some source code leaks of Windows versions, but Wine developers don't want to go anywhere near them for legal reasons. If they reimplement something in Wine after seeing original Windows code, Microsoft's lawyers could spring into action. So "clean room" implementations are required, accomplished by studying the behavior of Windows.

Second, Windows is a moving target. If the Wine team had set a goal of supporting, say, Windows 98 with maximum compatibility, they might have reached that by now, and the open source world would have a fully FOSS Windows 98 alternative. However, many other Wine users want support for newer APIs and Windows features, so the Wine team has had to keep chasing this ever-changing goal. It's tough work, so massive kudos to the developers for doing it.

program you want to run. Then, in the `winecfg` tool, you can choose to override Wine's version with the native version.

Other tabs to look at include *Drives* (where you can change the mapping of `C:` and `Z:`), *Graphics*, and *Audio*. Now, say you've done all the tweaking possible to make a program work in your Wine installation, but you want to install another app that requires very different compatibility, library override, and graphics settings. Do you have to poke around inside `winecfg` each time you switch apps?

Fortunately not. Wine includes a feature called "prefixes" (or "bottles") that lets you maintain multiple Wine installations simultaneously. It's a bit like having separate versions of Windows on your machine. If you've downloaded a program called CoolApp that you want to install and run in its own Wine installation, you can create a new prefix by setting an environment variable like so:

```
env WINEPREFIX=~/.wine_coolapp
  wine coolapp.exe
```

This command creates a new folder in your home directory called `.wine_coolapp` with all the Windows directory structure, DLLs, and tools as before, but it's completely separate from your other Wine installation. To use programs inside it (or the `winecfg` tool), just specify the environment variable before the command, as above. These separate Wine installations can take up a fair amount of disk space, however, so don't forget to remove them when you no longer need an app or game!

A similar environment variable is `WINEARCH`, which chooses whether to run in 64-bit or 32-bit mode. If you're running a 64-bit distro but are having trouble with some Windows apps in Wine, try using `env WINEARCH=win32` at the start of your commands.

Extra Resources

Inside the `.drive_c/windows/` directory of your Wine installations, you might have noticed a few `.exe` files. Wine includes simple versions of Windows Explorer, Notepad, and Registry Editor (Regedit, Figure 5). Regedit is especially useful for fine-tuning settings and fixing compatibility issues. You can run it in place with:

```
wine regedit.exe
```

An especially useful online resource for checking compatibility of programs under

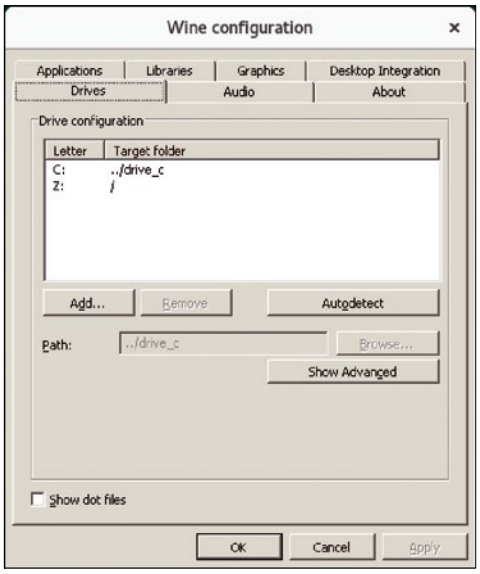


Figure 4: The `winecfg` tool provides a fairly user-friendly front end for fine-tuning your Wine installations.

Wine is the Wine AppDB [5]. You can see that apps have different ratings, such as platinum (runs perfectly without any Wine tweaking required), gold (runs perfectly but needs some configuration), silver (has minor issues but is otherwise usable), and so forth.

Use the search bar to find the apps you want to use, and check whether other Wine users have made any comments at the bottom of the page; they often contain useful tips and tricks for that specific app. If you've had success getting a program to run, but it's not listed in this compatibility database, click *Submit App* in the menu on the left to add a

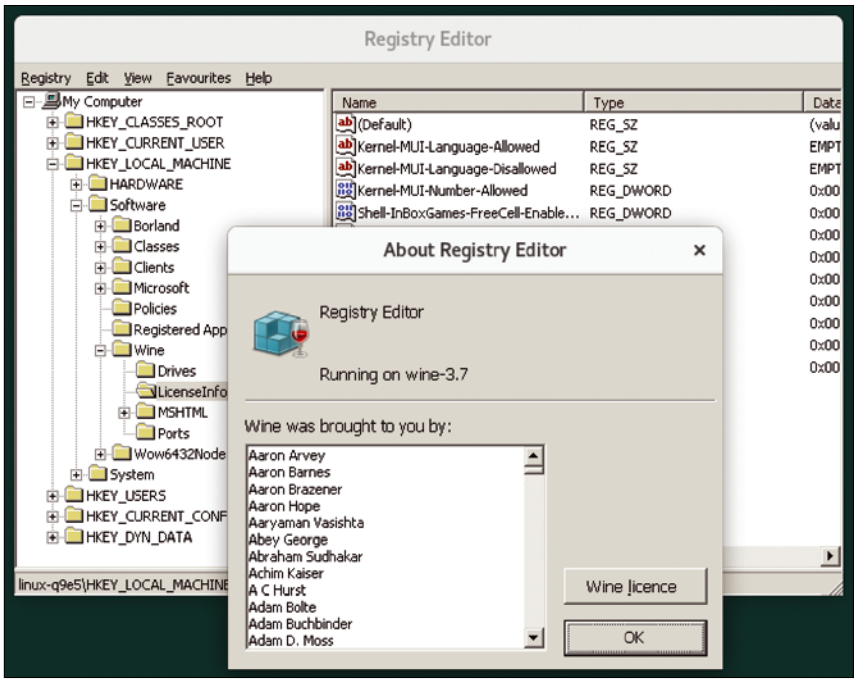


Figure 5: Wine is bundled with various tools, such as its own editor for the dreaded Windows Registry.

new entry and describe how well it works and what you had to do.

Last, Winetricks [6], an "easy way to work around problems in Wine," is a script that assists with the installation and setup of some common apps. Load it via your web browser, then save it to your home directory, and run it in a terminal:

```
sh winetricks
```

A menu will appear offering to help you install apps or games (Figure 6), so just choose what you want to do and follow the instructions.

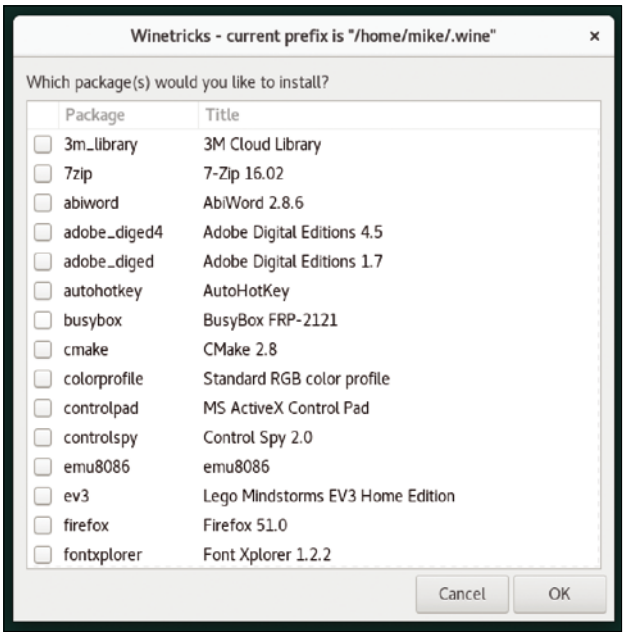


Figure 6: Winetricks lets you install various well-known Windows apps in Wine with just a few clicks.

Winetricks can save you a huge amount of time if you need to install many programs in Wine, but it's still important to know how Wine works under the hood – hence the "do it yourself" approach described earlier. With this knowledge and Winetricks at your disposal, you're in a strong position to get you and your friends and colleagues off Windows for good (see the "Alternatives to Wine" box for more information). ■

ALTERNATIVES TO WINE

If classic MS-DOS games float your boat, it's worth checking out DOSBox [7] (see also the "Retro Gaming" article in this issue), a full-fledged emulator that includes a virtual x86 processor and basic DOS implementation and is capable of running a huge number of old DOS games. Install it from your distro's package manager, and then start it by simply providing a directory as follows:

```
dosbox <mydir>
```

This starts a new DOS session, with the `C:` directory mapped to `mydir` (or whatever you specified). Now you can enter the good old `dir` command to view files inside the directory or run a program. If you're running a game and DOSBox grabs control of your mouse pointer, hit Ctrl+F10 to get it back.

DOSBox is highly configurable: You can change how fast the emulated CPU runs, customize the virtual video and audio devices, and much more. The DOSBox wiki [8] is packed with information on fine-tuning the emulator, so take a look. Oh, and it's even possible to run Windows 3.1 inside DOSBox [9].

Another alternative to Wine – or more precisely, a commercial version of Wine – is CrossOver [10]. CrossOver is like a value-added version of Wine with extra compatibility patches, configuration tools, and other bits 'n bobs. So, if you're having trouble getting something to work under Wine or need support, it's worth investigating. Plus, changes to CrossOver are rolled back in to the Wine codebase, so the original open source project benefits.

INFO

[1] Wine download: *https://www.winehq.org/download*
[2] Building Wine: *https://wiki.winehq.org/Building_Wine*
[3] Minez: *http://windrealm.org/minesweeper/*
[4] AbiWord: *https://www.abisource.com/downloads/abiword/2.9.4/Windows/*
[5] Wine AppDB: *https://appdb.winehq.org*
[6] Winetricks: *https://raw.githubusercontent.com/Winetricks/winetricks/master/src/winetricks*
[7] DOSBox: *http://www.dosbox.com*
[8] DOSBox wiki: *http://www.dosbox.com/wiki*
[9] Run Windows 3.1 in DOSBox: *https://joshmccarty.com/2013/08/run-windows-3-1-in-dosbox/*
[10] CrossOver: *https://www.codeweavers.com*

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Anonymous surfing on the Internet

Privacy First

Users who want to surf the Internet anonymously need to consider the Tor network. The Tor Browser package offers a simple solution for protecting your personal privacy.

By Erik Bärwaldt; revised by Bruce Byfield

The Tor Browser is one of the most widely used privacy tools in modern computing. It is a response to the data collectors that crowd the Internet – the secret service agencies, marketers, criminals, and anyone else who lies in wait to gather and misuse unsuspecting users' personal data. The Tor Browser protects users at one of the most vulnerable points on their system, namely the browser and its add-ons.

A web browser's standard settings leave the user wide open to real risks. Browsing habits can be captured and identified, making the user vulnerable to malware attacks. Manually hardening the software is a possibility, but requires experience with techniques for guarding against attacks. The Tor Browser offers a simple, easy-to-understand solution for users wanting to block snooping and overzealous data collection.

Lead Image © Corina Rosu, 123RF.com

How It Works

The Tor bundle combines several reliable technologies from open source software, achieving a very high level of security. The Tor network and the Firefox web browser function as the central components of the bundle. The Tor team has enriched Firefox with several preconfigured add-ons and then configured the browser so that it searches for Internet access exclusively via "onion routing." You could manually install both components, but that would take a lot of configuration work. Using the Tor Browser package helps those who are worried about security but lack expertise in security and data privacy.

Note that Tor is designed primarily to work with Firefox. However, there is a Chrome implementation, which you can easily find online, together with installation instructions.

The Tor concept was developed by the year 2000. In 2002, a pre-alpha version of the Tor Project was introduced to the public, allowing users to anonymize their Internet connectivity data. The Tor Project is suitable for secure browsing but also for IRC, email, and messaging services. The software operates on the onion principle, protecting the user with a series of Internet addresses. The Tor client's data traffic is directed to a so-called entry guard (the entry node), and this node transmits the traffic to another Tor node, a so-called relay node, that then sends the information on to an exit node, which serves as a doorway to the regular Internet. This model is so central to Tor that it uses an onion as its logo.

As an advantage of this approach, none of the nodes knows all of the information about a particular connection. For example, the entry guard knows where the request originates, but not to whom it is addressed. This information is only known by the exit node, which in turn does not know where the request originates (see Figure 1). The so-called mixed cascade changes its route

every 10 minutes so that the packets run continuously via new nodes. It is not known beforehand which nodes these will be, making it extremely difficult to attack or reveal the connection.

Tor, however, encrypts data only during traversal of its relay nodes. If you use the unencrypted HTTP protocol, rather than the more secure HTTPS, the information transmitted outside of the Tor network will remain visible. This means that an attacker could capture passwords that might be transmitted.

Installing the Tor Browser

The bundle from the preconfigured Tor client and the modified Firefox browser is available in various languages [1]. If you are a machine's only user, you can install it from within your `/home` directory, but, in most cases, you will want to install while logged in as root, using a suitable directory such as `/opt`. After downloading the version suitable to your architecture, you can unpack the archive with:

```
tar -xvf tor-browser
  -<linuxVersion>.tar.xz
```

Then, change to the newly uncompressed directory. From `./Browser`, enter `./start-tor-browser` to begin setting up the software. Using its graphical user interface, the tool will first ask how you would like to make contact with the Tor network. A user with a direct connection to the Internet would probably select a direct connection and click on the *Connect* button. After accessing the network, the modified browser based on Firefox v31.6.0 ESR will start. In the upper-left portion of the screen, you will find menu options for the browser security levels, with a slider to set your preferences (Figure 2).

Setting security levels is important because completely blocking all of the web techniques currently in use means that much of the content available over the Internet, especially multimedia content, does not display correctly. Therefore, you should avoid pushing the slider to the maximum protection level if you frequently visit sites with lots of optical gimmicks or multimedia content. Some basic settings are already activated to prevent spying by tracking services.

Customizing

Tor's onion icon sits on the upper left in the browser next to the address bar. As soon as you move to a web page, click the onion icon to see which route your data packets take. The route is shown in the form of IP addresses for the Tor nodes used to transmit data, as well as the location of the servers (Figure 3). You will also see that Tor chooses a new route every time another page is called. Next to the site address, you will find

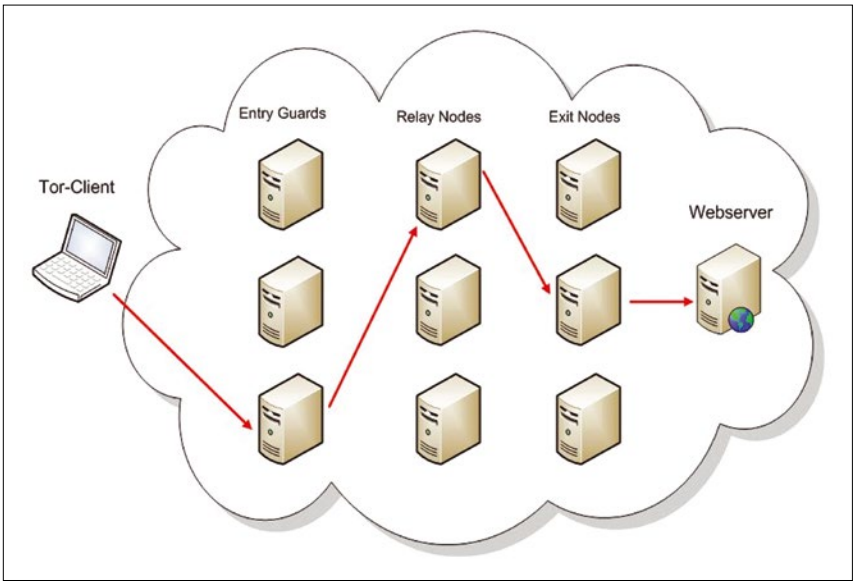

Figure 1: None of the onion routing system's three relay nodes has complete information about a connection.

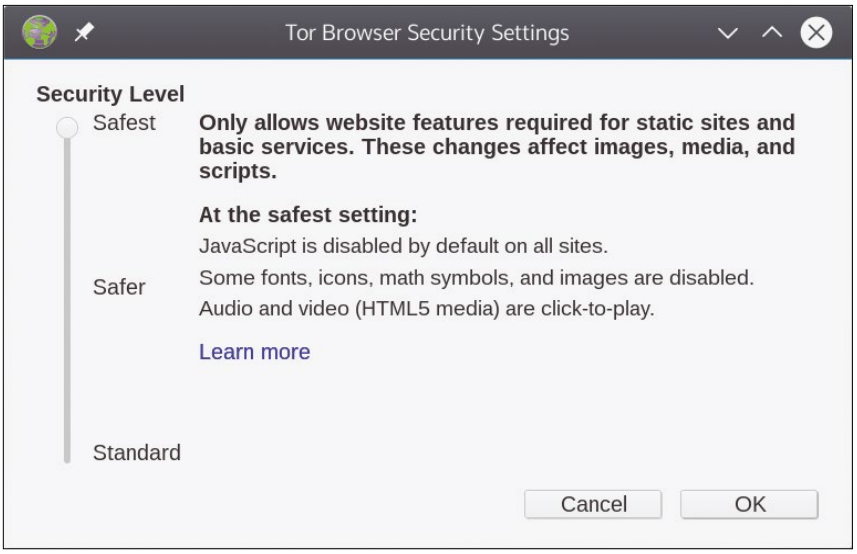

Figure 2: Security-level preferences can be set easily with a slider.

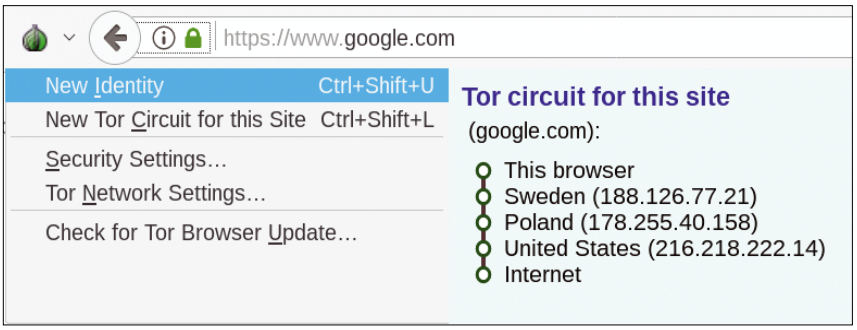

Figure 3: The route taken by your data packets.

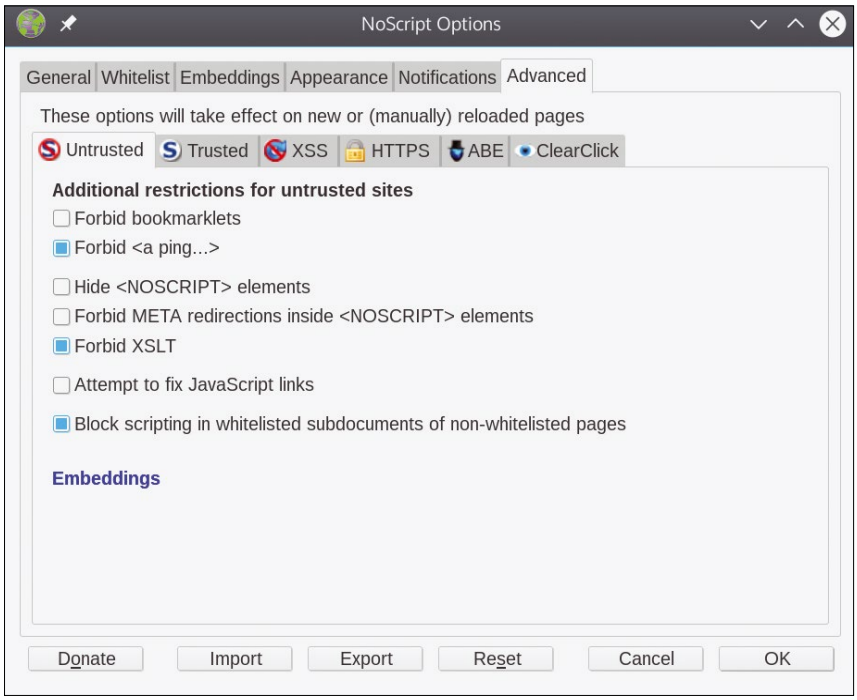

Figure 4: Tor configuration for using a site.

information about how Tor is configured to use the site (Figure 4).

Clicking on the icon for the NoScript add-on to the left of the Tor onion and selecting *Options* in the menu opens a dialog containing the tool settings. The Tor bundle developers put a lot of careful preparation into NoScript so that the settings are not too restrictive for most websites. However, if a frequently called website doesn't appear correctly because of a lack of rights, then you should enter the URL for the affected site in the NoScript Options dialog under *Whitelist* (Figure 5). The add-on for the site will then allow scripts to execute.

You can prevent Adobe Flash, Java, and other programs from loading with *Embeddings*. Remember that overly restrictive settings will cause websites to run incorrectly. Therefore, the browser comes with this filter deactivated. The settings under *Advanced* (Figure 6) make it possible to fine-tune add-on behavior. For this, the tool makes a distinction between trustworthy and untrustworthy

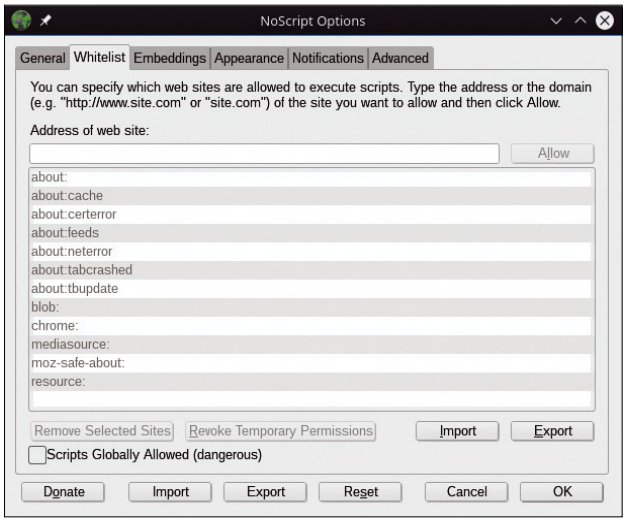

Figure 5: The NoScript add-on gives you fine-grained control over how to deal with scripts embedded in websites.

sites and defines its own rules from the selections you have set or removed for the corresponding options. Keep in mind, however, that fewer restrictions means less security as well. Try to find a balance between security and convenience with which you can live.

Additionally, the *HTTPS* tab lets you force or prevent encrypted connections for addresses that you can choose as you wish, but because the developers of the Tor bundle have already integrated the Firefox HTTPS Everywhere add-on, the browser already requests the encrypted version of all sites called.

In addition, Tor modifies Firefox's default configuration. While the Tor browser is running, Firefox does not create a browsing history and does not save passwords. Nor is the Tools menu available, which means that, among others things, you cannot install or update extensions. In fact, the entire menu is unavailable and does not display. These settings preserve the privacy and security settings used by Tor. If you want to change any settings or use any of Firefox's tools, you will need to close Tor and run an ordinary Firefox session. Needless to say, by doing so, you lose your anonymity, so these changes should not be made unless absolutely necessary if you value your privacy.

Advertising and Tracking

Commercial websites can be so cluttered with banners and animated content that the user loses sight of the actual content. Many sites also load so-called web pixels that often, unbeknownst to the user, track user surfing behavior to many other sites.

Firefox offers add-ons, such as Adblock Plus and Ghostery, for dealing with these irritations [2]. However, the Tor Project does not include them. It is a good idea to install these manually. You will find that the browser speeds up because unnecessary DNS queries disappear. It is also advisable to add the filter subscription *Social Media* for Adblock Plus to prevent tracking by social media services like Facebook and Twitter [3].

Quick Security

Installing and configuring Tor probably takes less time than reading this article. So long as you take the time to consider the security options for each site, it can significantly increase your privacy while minimizing any inconvenience. The developers have preconfigured the relevant settings

very well, so you won't need to worry much about manual configuration. The bundle's only flaw is the lack of add-ons like Adblock Plus and Ghostery, but you can easily fix that with manual installation, which requires just a few mouse clicks. Once you have taken the time to customize your favorite sites, you can go about your business while Tor works in the background, protecting you while you ignore it, except when you start frequenting another site. ■

INFO

[1] Downloading the Tor Browser: *https://www.torproject.org/download/download-easy.html.en*
[2] Firefox add-ons: *https://addons.mozilla.org*
[3] Adding a subscription: *https://adblockplus.org/en/features*

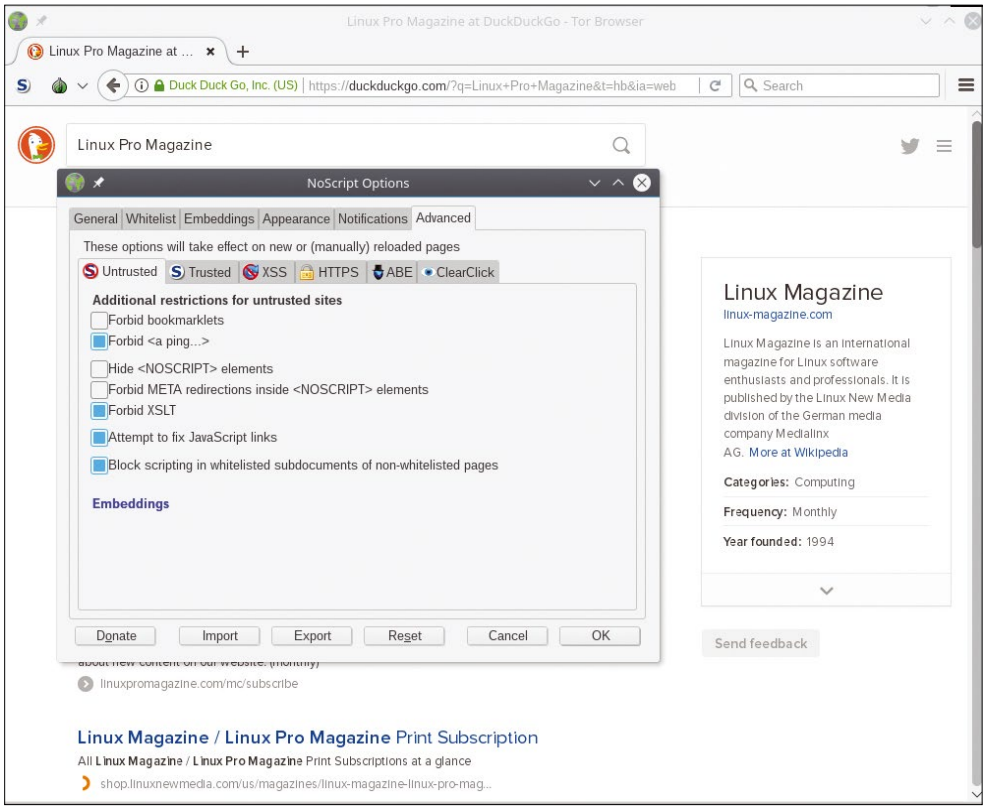

Figure 6: Selecting *NoScript* | *Options* | *Advanced* lets you fine-tune your security settings.

Personal information management

Desktop Organization

KDE Plasma's PIM tools help you organize your contacts, calendars, and email efficiently. *By Bruce Byfield*

In KDE Plasma, contacts, calendars, email, and other personal information are all managed by the same database. Because of this arrangement, you can easily pass information back and forth between these personal information management (PIM) tools once they are set up. You can use the tools individually, or you can use Kontact (Figure 1) to move back and forth easily between them. Once you are set up, you can even use the other tools from within the email browser. You pick which solution suits you best.

Regardless of how you use these tools, before using any of them, if you plan to use encryption, install either Blowfish or GNU Privacy Guard (GPG) encryption – preferably, GPG. The first time you use a PIM tool, the Account Assistant opens (Figure 2). When you enter your email address and password, the Account Assistant does its best to offer the options used by your Internet provider. You will also need to supply the incoming and outgoing mail servers for your account and set up KWallet, a password manager, using either Blowfish or GPG encryption.

When the Account Assistant closes, you are ready to send basic email. Before you do, though, you should set up your contact list and calendars, as well as a number of options for email. Fortunately, while all these applications can be extensively customized in looks and features, you only need a small subset of all the available options to get up and running. You can explore the rest later, including some of the other personal information apps included in Kontact.

KAddressBook

KAddressBook installs with an empty address book labelled Personal Contacts. If your contacts are extensive, you might want to create new address books by right-clicking in the left-hand Address Books pane, so that you can find contacts more easily. For instance, you might have a separate address book for work clients and another for family members.

As you send and receive email, you can add people to your address books. You also can enter contacts manually from the toolbar. If you have contacts from another system, you can import them in one of the formats listed in *File* | *Import* (Figure 3). Most contacts can be exported to vCards or, all else failing, to comma-separated values (CSV). You can also create groups or mailing lists of people you often email at the same time, to save the effort of entering them manually.

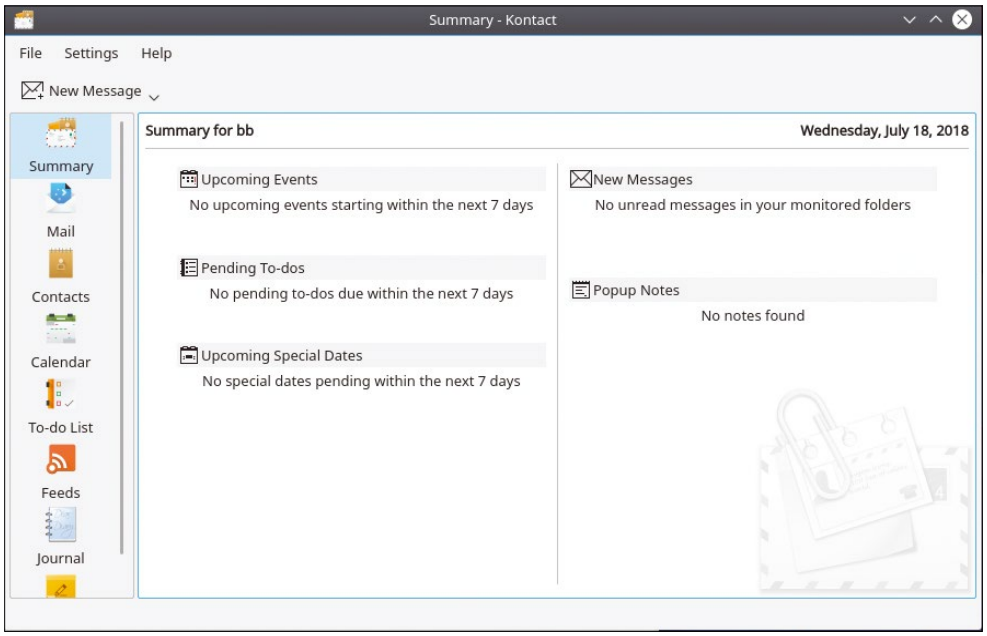

Figure 1: Kontact groups PIM tools in an overview, complete with summary.

In KAddressBook, you can use *Tools | Search Duplicates* to keep your address books tidy, or the View menu to change the theme and layout.

KOrganizer

To use KOrganizer, you must have at least one calendar enabled. The defaults are Birthdays, Anniversaries, and Personal Calendar, but you can add or delete calendars by right-clicking on the panes that list them. The default view – the current week, with the current time shown in red – can be changed in the View menu.

You can add new events automatically from another person's email or manually from KOrganizer's toolbar. At a minimum, an event must have a title, location, start and end times, and be assigned to a calendar (Figure 4). If necessary, you can add additional information from the tabs in the bottom half of the event's dialog window. An especially useful tab is *Reminder* (Figure 5), which lets you set reminders and choose whether each reminder takes the form of a sound or a

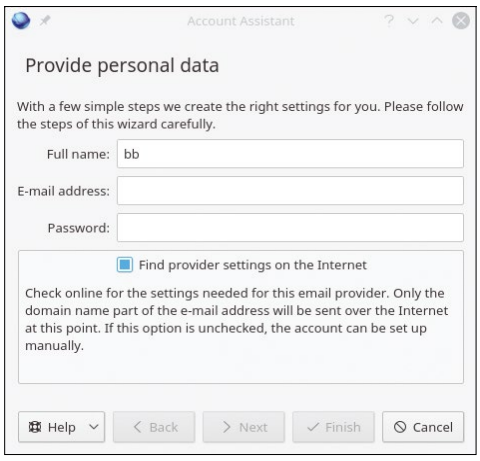

Figure 2: The first time you use any PIM tool, the Account Assistant sets up your Internet connection, including storing the password securely in KWallet.

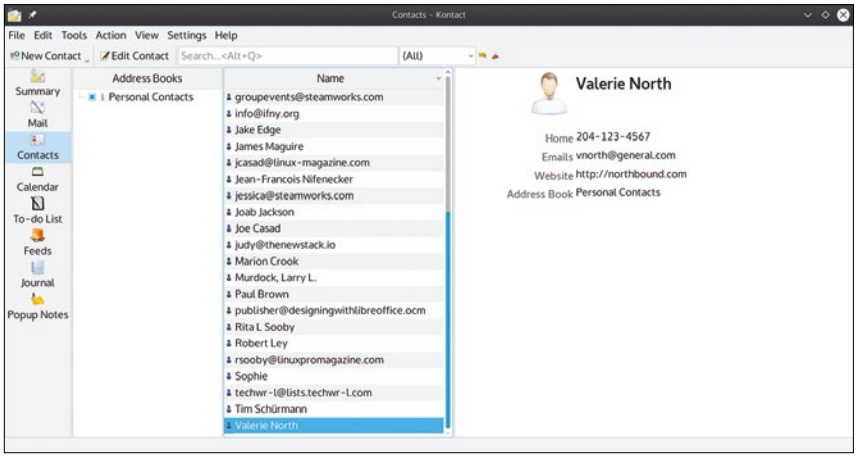

Figure 3: Import contacts from other sources to populate your address books.

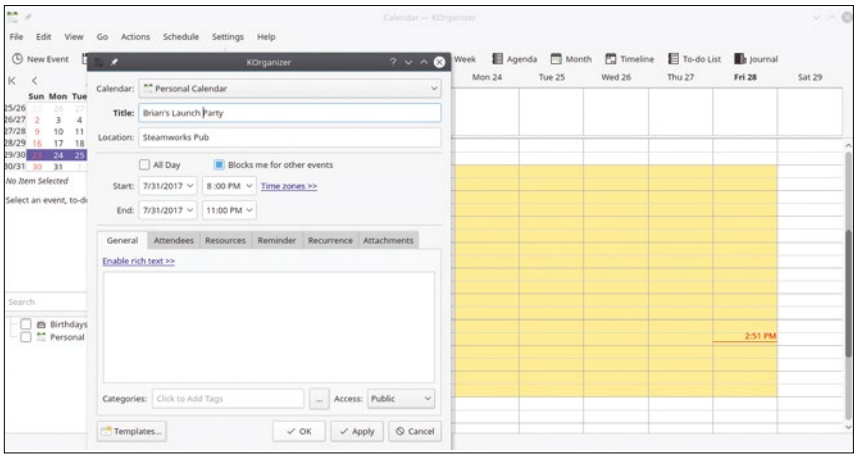

Figure 4: KOrganizer is a highly configurable app for scheduling events, as well as any other list.

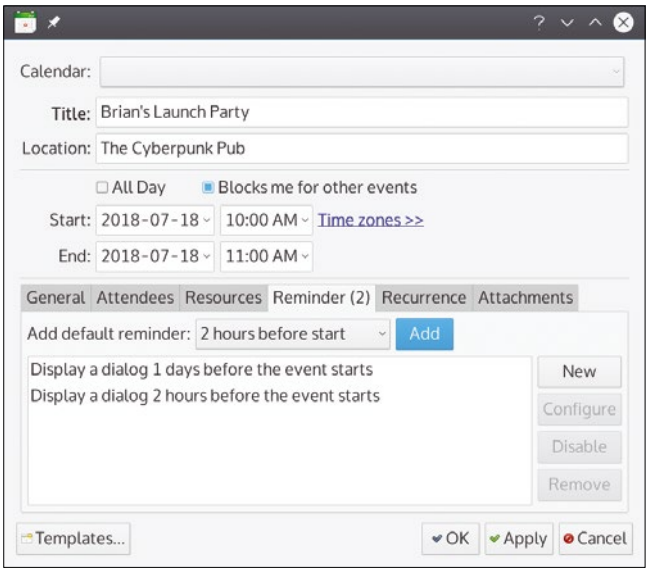

Figure 5: KOrganizer schedules not only the basic details of an event, but can also schedule reminders and recurrences, as well as store information about who is attending an event and any relevant files.

pop-up window. In some cases, the *Recurrence* tab can save you the trouble of rescheduling a regular event. To change these details, click the event on the calendar.

In addition to events, KOrganizer can also create other time-relevant items, such as to-do lists and private journals.

KMail

Of all the PIM applications, KMail is the one where users generally spend the most time. For this reason, you can create and open the calendars and to-do lists from the Message menu and address books from the Tools menu.

After you run the Account Assistant, you should be able to use email. If necessary, click *Tools* | *Account Wizard* to make any adjustments, including an additional email address. Before you start using email, though, you should also add a few more customizations. To start, install either Bogofilter or SpamAssassin, and then run *Tools* | *Anti-Spam Wizard* to help protect you from spam. Similarly, install an antivirus application such as ClamAV, and run *Tools* | *Anti-Virus Wizard* so that KMail can use it.

If you want to send encrypted email – which increasingly seems like a basic necessity – create a public and private key with some form of OpenPGP like GPG. Then, when you choose *Options* | *Encrypt Message* while writing a message, encryption within KMail is reduced to a matter of a few clicks. Of course, email encryption cannot take place without an exchange of keys, which is why KMail's message window includes the option to attach your public key in the Attach window.

To help manage your email – especially if you receive large volumes – consider creating additional folders and creating filters from *Tools* | *Configure Filters* (Figure 6). Filters can be used to move messages that meet the assigned criteria directly to the Trash or to arrange email by senders or subject matter to help you find them and decide their priority. Each filter consists of a set of criteria that must be met, such as who the email is from, and an action to be taken. Setting up filters may take some time, and you may need to adjust the order in which they are applied, but a set of personalized filters can do a lot to help you gain control of your email.

Other settings you might want to consider are available in *Settings* | *Configure KMail*. They include:

- Creating separate identities for each account, to keep your online activities separate from one another.
- Setting a policy that specifies how you react to requests from others for confirmation that a message has been received. For the sake of privacy, *Ignore* or *Ask* are reasonable options.
- Enabling AdBlock to minimize spam and other forms of advertising. Basically, this option is an added form of spam control.

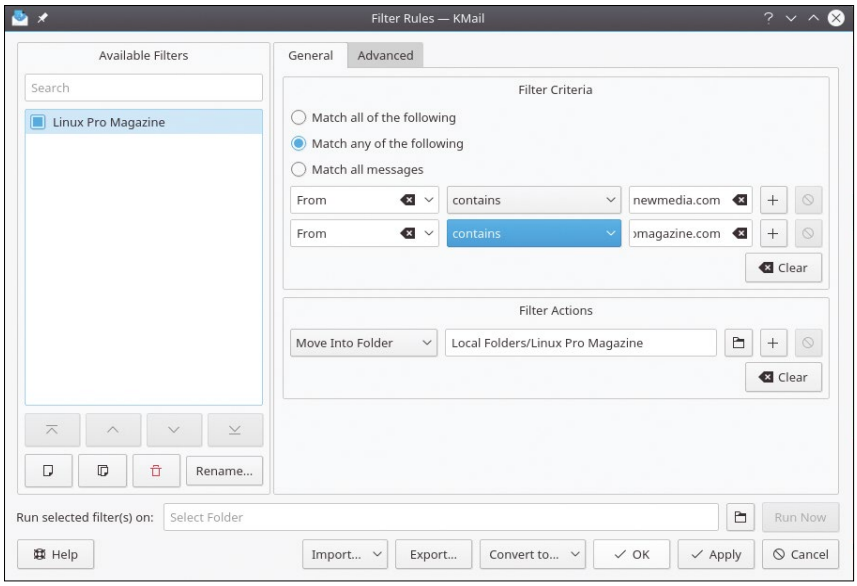

Figure 6: Filters help you to organize your email.

- Automatically inserting a signature for each email. The setting requires a link to a text file. Try to keep it to no more than half a dozen lines – less if possible.
- Detecting a missing attachment by the means of keywords.

All of these settings say nothing about the cosmetic options throughout the KMail menus, such as window arrangement or theme choice.

Still, one last thing: Take the time to familiarize yourself with the options in the Compose window. For example, rather than sending a message, KMail can save it as a draft or save it to send later – either of which is handy if you suspect you may have second thoughts about sending the message. Other message options include *View |Translator* and *View | Generate Shortened URL*, as well as regular or automatic spell-checking. All these settings and others can enhance and ease your use of email.

Typical Plasma

These PIM tools all illustrate the philosophy behind Plasma applications. Although the latest versions of these tools have benefited from a major overhaul of their interfaces in the last few years, they share the typical Plasma attitude of including every feature possible.

At first, this design can seem overwhelming to newcomers. Mercifully, though, most of the default settings are reasonable, and you can ignore many of the options unless you want to change them. Choose the features you will use and begin with them. Should you run into any difficulties, you should be able to troubleshoot using the Akonadi Console, the utility for managing the database and resources for all the PIM tools (Figure 7).

Later, you can explore other options. Meanwhile, by customizing the PIM tools, you can set up your connected life more efficiently and learn what to expect as you explore other KDE applications. ■

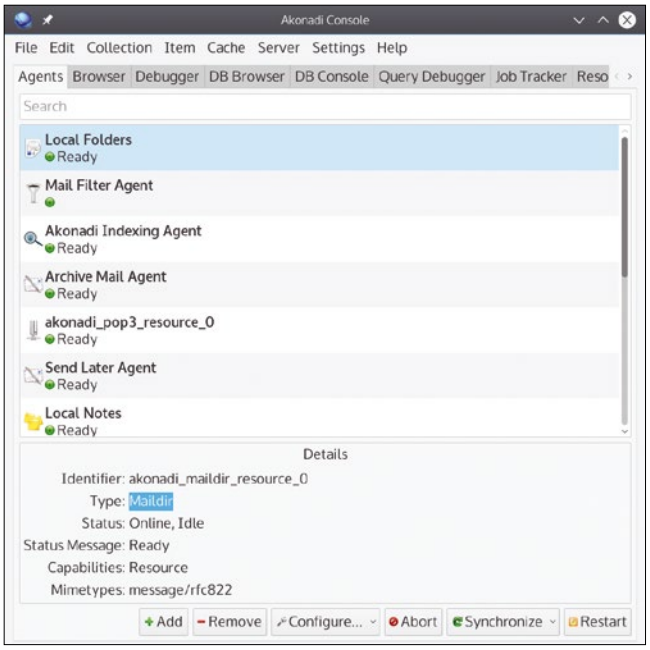

Figure 7: You can troubleshoot your PIM tools using the Akonadi Console.

Manage photos with digiKam

digiKam Primer

Master digiKam's essential functionality in no time. *By Dmitri Popov*

In a way, digiKam is an underappreciated application. Many Linux users may have heard that it's a decent tool for managing photo collections. However, they might not be aware of digiKam's more advanced features or the fact that this application offers functionality that covers the entire photographic workflow. This article introduces some of digiKam's key features and shows how they can be used to set up a complete workflow, including importing, organizing, and editing photos and RAW files. For information on installing digiKam, see the "digiKam AppImage Package" box.

Importing Photos and RAW Files

DigiKam features a rather capable import module that makes it possible to transfer photos and RAW files from your camera into the application, as well as process and organize them on the fly. In fact, the import module offers a few clever features that allow you to configure the import operation (Figure 1). In the *File Renaming Options* section in the *Settings* sidebar, you can define a custom rule that renames all incoming photos. Say you want to rename imported photos using their date and time info pulled from Exif metadata. Enable the *Customize* option, and select the *Date & Time* item from the *Options* drop-down list. From the drop-down list next to the format field, select the desired date and time format. The available options include *Standard*, *ISO*, *Text*, *UnixTimeStamp*, and *Custom*, which allows you to specify your own date and time format. For example, enter the *yyyyMMdd-hhmmss* rule in the format field to rename photos as in this example: *19730917-175735*.

The options available in the *Auto-creation of Albums* section can come in handy in several situations. If you are downloading photos taken on different dates, enable the *Date-based sub-albums* option and choose the desired date format. This will organize imported photos in albums by date. The *Extension-based sub-albums* option can be useful for importing photos in different formats into separate albums. For example, if you shoot in both RAW and JPEG, you can enable this option, and photos will be imported into appropriate

digiKam AppImage Package

If you want to try the very latest version of digiKam, you either need to install it from a third-party repository or compile the application from source. There is also a third option: Use the digiKam AppImage Package. It is a single file that contains all the required files and libraries. This means that you don't need to install anything: Grab the latest AppImage Package from the project's website [1], and make the downloaded file executable using:

```
chmod +x digikam-x.x.x.appimage
```

Then double-click on the file to launch digiKam. This convenient option does have a couple of drawbacks, though. It's slower to launch and offers no system integration. Also, it's not possible to modify the application's files, so you can't replace the default splash screen and add custom presets.

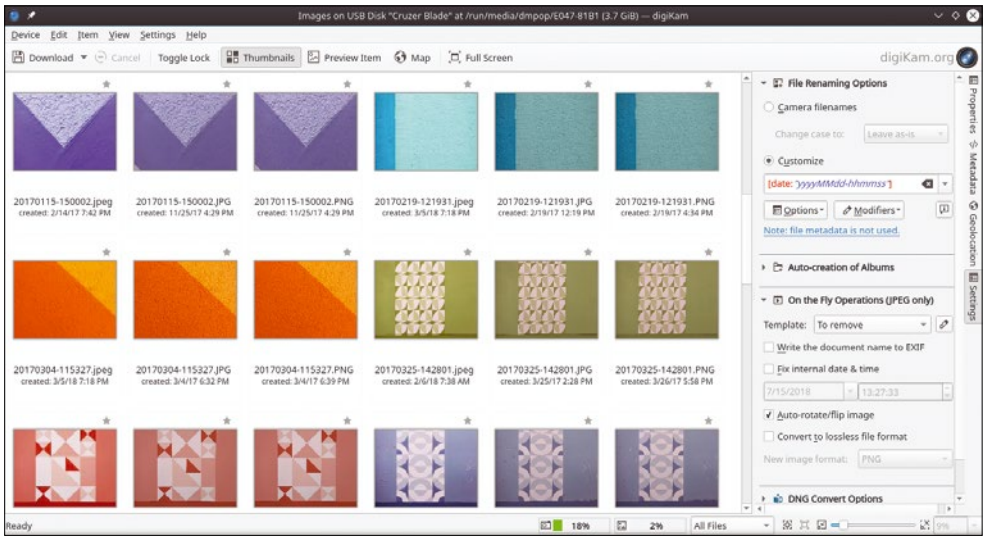

Figure 1: The import module allows you to rename, organize, and process photos and raw files on the fly.

folders on the basis of their file extensions. Finally, the *On the Fly Operations* section allows you to configure several actions to be performed on the photos during the import process. Among other things, you can let digiKam autorotate photos and convert them to another format like PNG or TIFF.

The Image Quality Sorter

Here's a problem that may sound familiar: You return from a trip with hundreds and even thousands of photos, and some of them are underexposed, out of focus, or too noisy. Weeding them out manually is like catching fish with a spoon. This is where the Image Quality Sorter tool in digiKam can prove its worth. To enable it, choose *Settings* | *Configure digiKam*, switch to the *Image Quality Sorter* section, and tick the *Enable Image Quality Sorting* checkbox (Figure 2). Although you can modify the available settings, you might want to try the default values first: Create a separate album containing both good and low-quality photos, and then run the Image Quality Sorter using the default values. Next, adjust specific parameters, if necessary. The Image Quality Sorter feature is part of the Maintenance tool. To process existing photos in all or selected albums, choose *Tools* | *Maintenance*, enable the *Image Quality Sorter* option, and run the maintenance operation. The Image Quality Sorter then goes through the photos and flags them according to their quality.

Color Labels and Picks

Like any other decent photo management application, digiKam allows you to assign tags to photos and RAW files. But in addition to tags, digiKam also offers color labels and picks, which can be useful for keeping tabs on your photos. To add a color label to an individual photo, right-click on it, choose *Assign Labels* | *Color*, and select the desired color. Each color label has its own shortcut, so you can quickly label photos using the keyboard. For example, to assign the Magenta label, press Ctrl + Alt + 6. To remove a color label quickly from a photo, press Ctrl + Alt + 0. Picks work in a similar manner: You can assign one of three picks – Pending, Accepted, or Rejected – to any photo in digiKam via *Assign Labels* | *Pick*, or by using the default shortcuts. Keep in mind that the Image Quality Sorter tool uses picks to flag photos, so to avoid confusion, you might want to avoid using picks when this tool is enabled.

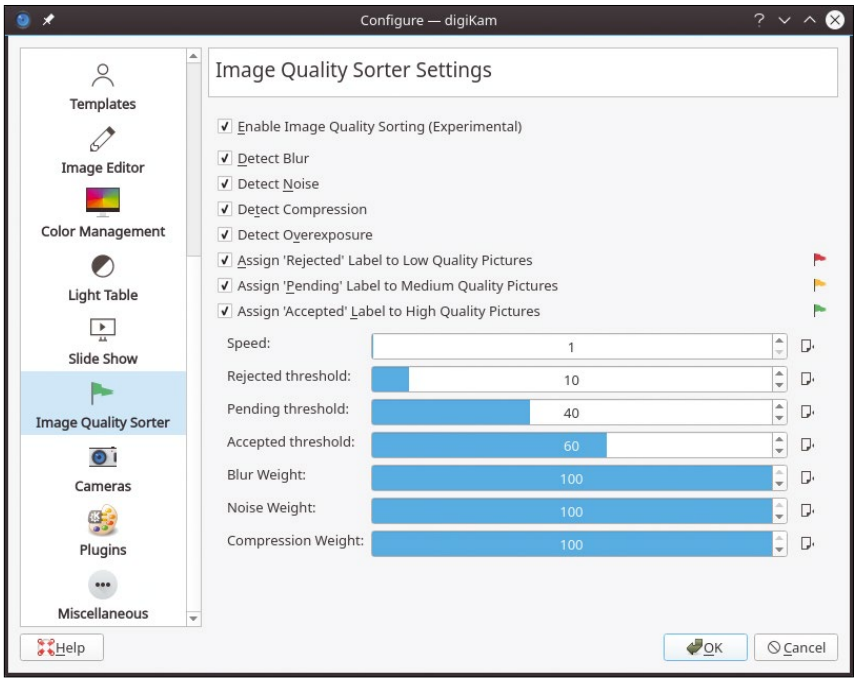

Figure 2: Enabling and configuring the Image Quality Sorter.

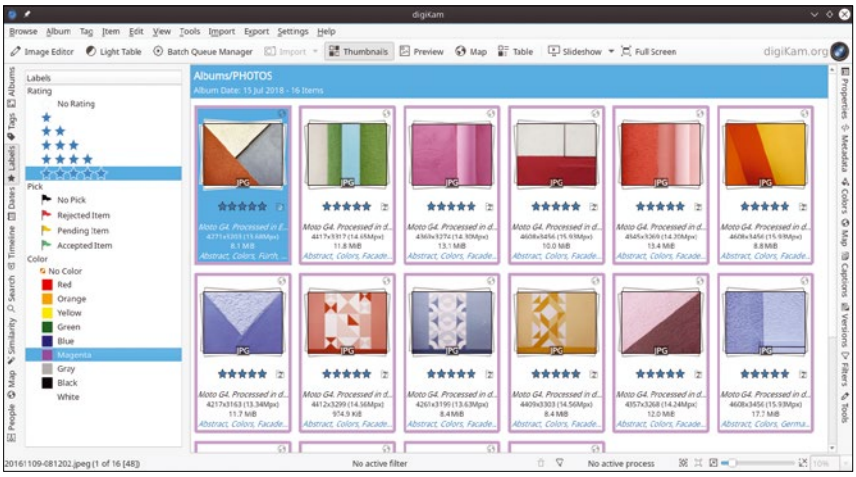

Figure 3: The *Labels* sidebar can be used to quickly filter photos by color, pick, and rating.

DigiKam provides two ways to find photos with specific color labels or picks. The *Labels Filter* section in the *Filters* sidebar lets you filter photos in the currently viewed album by color labels and picks. Using filtering capabilities can be useful when you need to specify multiple filtering criteria (e.g., show all photos with Green and Orange color labels, as well as the Pending pick), but you can only view one album at a time. If you need to filter photos quickly by one or two criteria, the *Labels* sidebar is the way to go. The sidebar contains a list of all labels supported by digiKam grouped by their type: rating, pick, and color (Figure 3). Select the desired label to view all matching photos. You can select several labels by clicking on them while holding down the Ctrl key. It's worth noting that quick filters in the *Labels* sidebar are applied to the entire digiKam photo collection (as opposed to filters defined in the *Filters* sidebar, which are applied to the currently selected album).

GEOTAGGING

If your camera doesn't support geotagging, you can easily add geographical coordinates to your photos using digiKam. In digiKam, select the photos you want to geotag and choose *Item | Edit Geolocation*. This opens the Geolocation Editor interface consisting of three parts: The map pane contains a map and a toolbar with several navigation tools, below the map pane is a list of selected photos, and the sidebar on the right displays the currently active section.

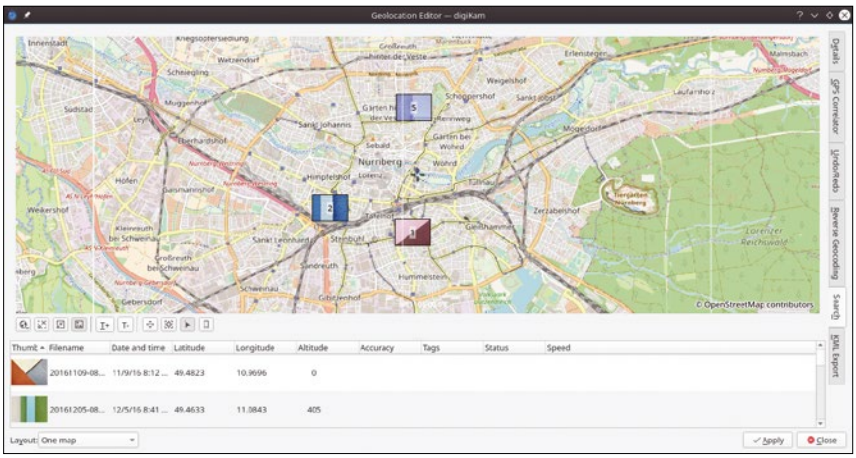

Figure 4: Geotagging photos in digiKam.

To geotag photos, you need to obtain the geographical coordinates of the place where the photos were taken; the Geolocation Editor offers several ways to do this. For example, you can mouse over the map to locate the desired spot, or, if you know the full or partial address of the location, you can use the built-in search feature to find it on the map. Switch to the *Search* section and enter the address in the search field. Hit the *Search* button, and you should see a list of matching results with corresponding markers on the map (Figure 4).

The easiest way to add geographical coordinates to the photos is to drag them from the list onto the desired spot on the map. Alternatively, you can assign a specific search result's geographical coordinates to the photos. To do this, select the photos in the list, right-click on the desired search result, and select *Move selected images to this position* from the context menu. Once you've assigned the geographical coordinates to the photos, press the *Apply* button to write geotags to the photos.

DigiKam also makes it easy to find geotagged photos. Need to find all the photos you took in Japan? You can use the *Map* sidebar to do just that, provided your photos have been geotagged. Expand the *Map* sidebar, and you should see thumbnails representing groups of geotagged photos on the map. Each thumbnail contains a counter indicating the number of photos found in the specific area (Figure 5). Click on the *Pan Mode* button in the map toolbar to control the map using the mouse.

To view all photos represented by a thumbnail, press the button that creates a region selection from a thumbnail (middle button in the *Search by area* section). Using the area selection button, you can view all photos in the manually selected area on the map. To do this, press the button, then click somewhere on the map, and draw a rectangle around the desired area.

DigiKam also lets you save map searches. This way, you don't have to perform the same map search every time you need to find photos in a specific region. Enter a

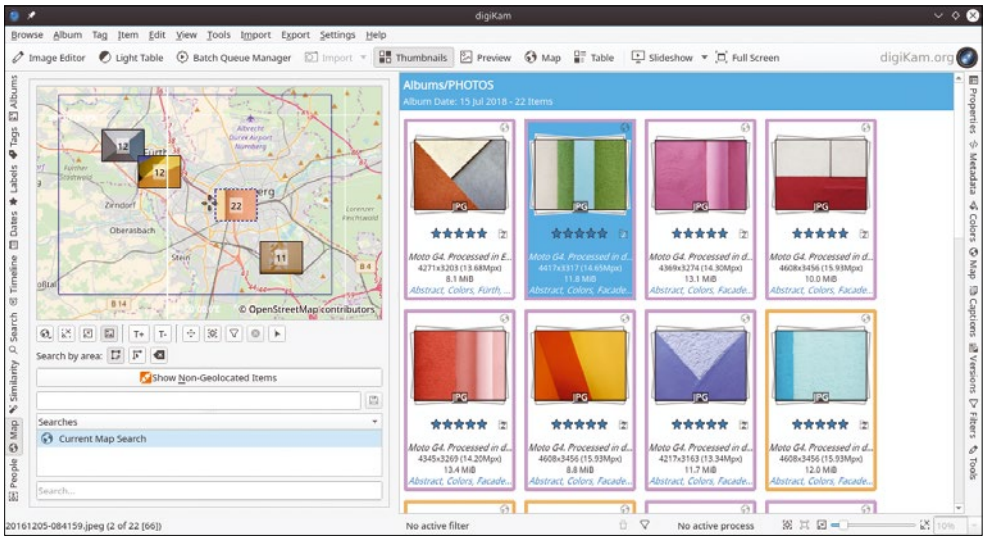

Figure 5: Finding geotagged photos.

name for your search in the field below the map and hit the *Save* button. This adds the search to the *Map Searches* section, and you can activate the saved search at any time by clicking on it.

Search and Filter Photos

Designed to manage hundreds and even thousands of photos, digiKam provides powerful searching capabilities that can help you find the photos you want in several ways.

If you need to locate or filter photos quickly, your first stop should be the *Filters* sidebar. Here, you can use a list of all available tags in the *Tags Filter* section to locate photos containing specific tags quickly. Select one or several tags, and digiKam returns all matching photos in the current album (Figure 6). To use the rating filter, specify the desired number of stars, and digiKam narrows the view to the matching photos. By default, the rating filter uses the *Greater Than or Equals* condition, but you can choose between two other options – *Equals or Less Than* and *Equals* – by selecting them from the *Rating Filter Options* drop-down list.

Although the quick search and filtering features can help you to find the photos you want with a minimum of fuss, keep in mind that the results they return largely depend on the quality and completeness of each photo's metadata. This is also true for digiKam's more advanced search features, so to be able to use them to their full potential, you should tag and rate your photos and add as much information as possible.

Besides the quick search and filtering tools in the *Filters* sidebar, digiKam offers more advanced search features accessible via the left sidebar. Here, you'll find a variety of search options, including *Dates*, *Tags*, *Timeline*, *Search*, *Fuzzy*, *Map*, and *People*.

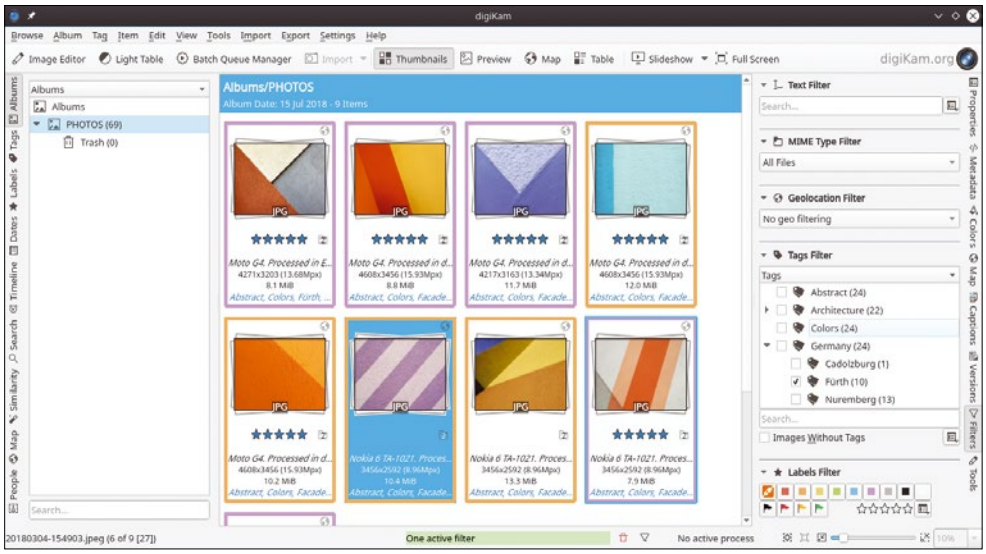

Figure 6: Using filters in digiKam.

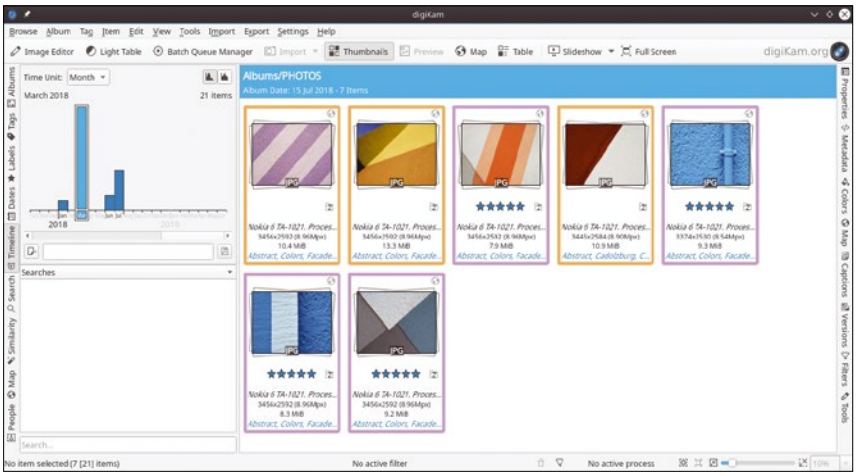

Figure 7: *Timeline* search section.

The *Dates* section lets you quickly find photos for a specific year, month, and day. Using the tree in the main pane, you can easily locate the year and month you want. Select the desired month, and digiKam promptly displays related photos. Want to view photos taken on a specific date? You can do this using the calendar at the bottom, where dates containing photos are marked in bold. Click on the date you want to view for the related photos.

The *Timeline* section offers another way to locate and view photos for a specific period of time. All photos here are presented as a bar chart, and you can view photos for a specific period by clicking on the related bar (Figure 7). The *Time Unit* drop-down list lets you specify the desired timescale for the chart: *Year*, *Month*, *Week*, and *Day*. The *Timeline* section has another clever trick up its sleeve: You can save searches as virtual albums. To save the current search, give it a name in the field right below the timeline and press the *Save* button. This adds the virtual album to the *My Date Searches* list.

The *Search* section lets you perform searches in a more traditional way. Type the search term in the *Search* field, and digiKam automatically displays the matching photos in the main pane. To make your search more precise, press the *Advanced Search* button. This opens the Advanced Search window (Figure 8), which allows you to search photos using a wide range of criteria – from tags and image properties, to specific text and metadata values. When configuring an advanced search query, you can at any time press the *Try* button to see whether it returns the desired photos. Once you're satisfied with the result, you can save the search for later use. Give the search a name in the *Save Current Search* section, and press the *Save* button. You can then run the search by selecting it in the *My Searches* list.

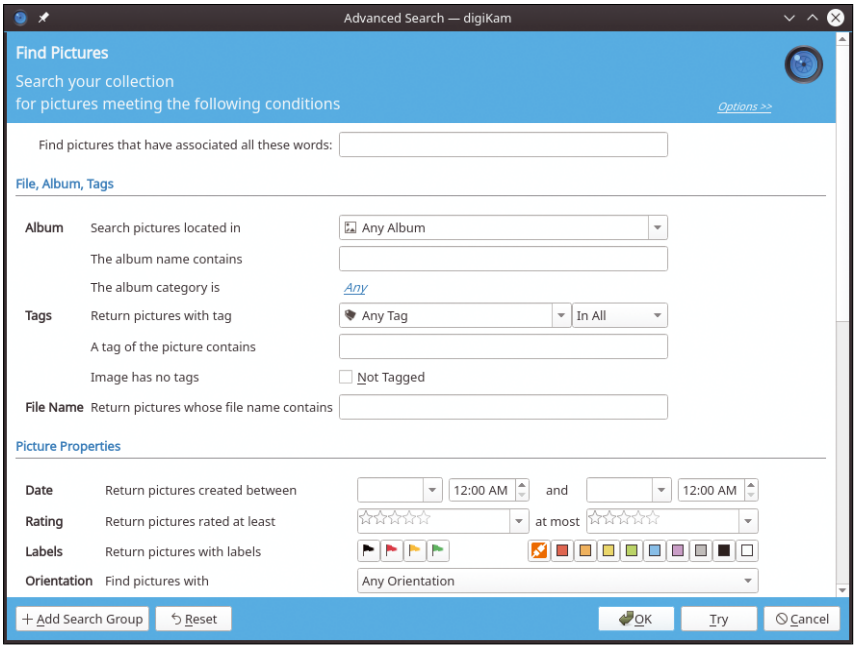

Figure 8: The Advanced Search feature offers a wide range of search criteria.

Processing RAW Files

DigiKam usually does a decent job of decoding RAW files using the default settings, but if you prefer to have complete control over how the application processes these files, choose *Settings* | *Configure digiKam*, switch to the *Image Editor* | *Raw Behavior* section, and enable the *Always open the Raw Import Tool to customize settings* option. Next time you open a RAW file for editing, digiKam drops you into the *Raw Import* module, where you can tweak the RAW import and post-processing settings (Figure 9).

The *Raw Import* sidebar contains three tabs: *Raw Decoding*, *Post Processing*, and *Info*. The *Raw Decoding* tab gives you access to settings that let you tweak demosaicing, white balance, noise reduction and chromatic aberration correction, and color management settings.

Demosaicing is a process of reconstructing a full-color image from the RAW output of an image sensor. The LibRaw library [2], which digiKam uses for processing RAW files, supports several demosaicing algorithms, including Bilinear, VNG, AHD, LMMSE, and others. You can use Shift + F1 to view a brief, and rather technical, description of each algorithm, but the best way to see the differences between various algorithms is to try to apply them to the currently opened RAW file. Select the algorithm you want, and press the *Update* button to preview the result. The preview pane

displays an image that will be imported into the editor, and you can use the zoom slider at the bottom of the window to zoom in on the image for closer examination.

By default, digiKam converts RAW files into 8-bit color images, but you can choose the 16-bit mode instead by enabling the *16 bits color depth* option in the *Demosaicing* section. The 8-bit mode is faster, but the 16-bit conversion is by far the best way to go, because it provides better tonal range. If you choose to work in the 16-bit mode, it's recommended that you enable and configure color management options in the *Color Management* section to prevent dark rendering of the image in the editor. Because of the way certain algorithms process green pixels, the resulting image can contain undesirable patterns and artifacts. Enabling the *Interpolate RGB as four colors* option can fix that. The *Do not stretch or rotate pixels* option is there specifically for Fujifilm's cameras with the Super CCD sensors and cameras using sensors with non-square pixels. When this option is enabled, the image is tilted 45 degrees, so that each output pixel corresponds to one RAW pixel. This option also prevents the image from stretching to its correct aspect ratio.

In the *White Balance* section, you can adjust white balance settings and specify how the system should handle highlight clippings (overexposed areas in the photo). LibRaw offers several algorithms for restoring highlight clippings – Solid White, Unclip, Bend, and Rebuild – and you can view their brief description by using Shift + F1. To process highlights more accurately, enable the *Correct false colors in highlights* option. If you want LibRaw to adjust brightness automatically, tick the *Auto Brightness* checkbox. Besides white balance, you can also enable and adjust the *Exposure Correction* option and manually tweak exposure compensation settings. The underexposure and overexposure buttons at the bottom can identify underexposed and overexposed areas of the photo in the preview pane, which can help you adjust exposure settings.

Using the options in the *Corrections* section, you can choose to apply one of the supported noise reduction algorithms to the image, as well as enable the chromatic aberration correction option and adjust its settings. And in the *Color Management* section, you can specify a color profile and a color space.

Under the *Post Processing* tab, you can adjust several exposure settings (e.g., brightness, contrast, gamma, and exposure), as well as adjust the luminosity curve. While these adjustments can be performed later

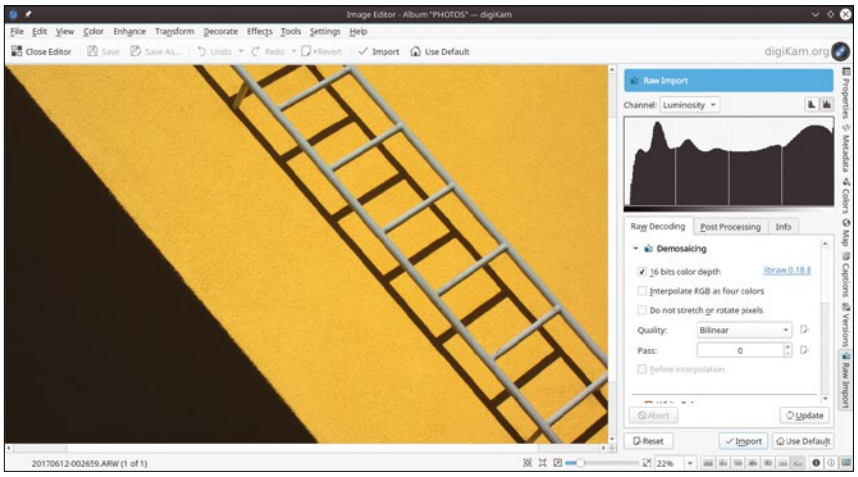

Figure 9: Processing a RAW file in digiKam.

when editing the converted image, you can do this during the RAW import to streamline the editing process. digiKam applies all adjustments to the preview image, so you can immediately see the result of your tweaking without performing the actual conversion.

Once you're satisfied with your settings and adjustments, press the *Import* button to import and process the RAW file. And remember: When in doubt, press the *Use Default* button to let digiKam import the RAW file using the default settings.

Adjusting Levels and Curves

When it comes to improving photos, the Levels tool is an important weapon in digiKam's arsenal. This tool lets you adjust brightness and contrast by specifying the location of complete black, complete white, and midtones in a histogram, which makes it a perfect tool for fixing underexposed and overexposed photos, as well as improving a photo's overall tonal range.

You can access the Levels tool in the image editor by choosing *Color* | *Adjust Levels* (Figure

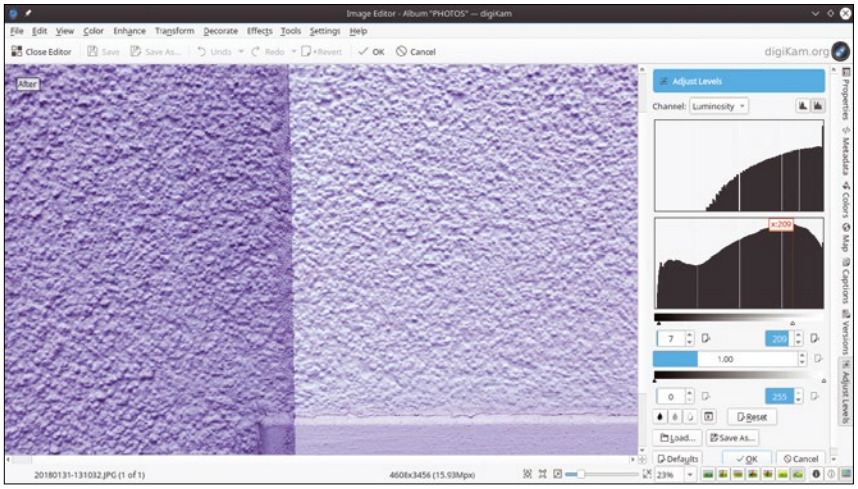

Figure 10: Using the Adjust Levels tool.

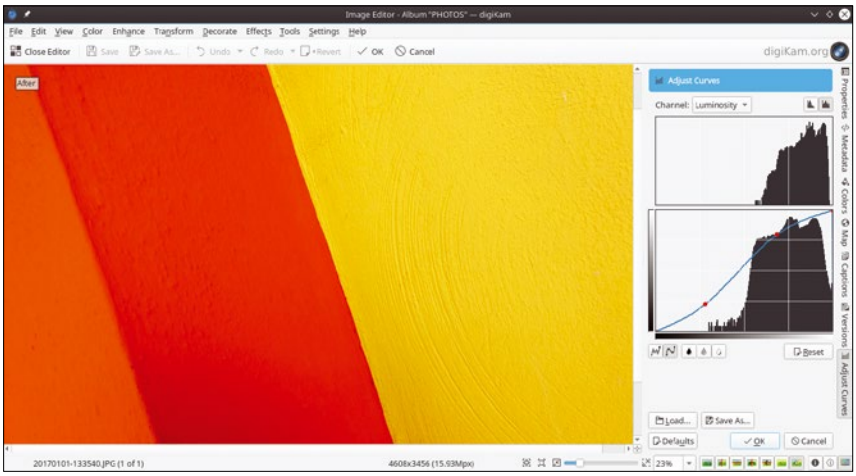

Figure 11: The Adjust Curves tool.

10). Select *Luminosity* from the *Channel* drop-down list, and press the *Linear* button. The key element in the *Adjust Levels* pane is the histogram with the black-point and white-point sliders. Simply put, the black-point slider controls shadows, whereas the white-point slider controls highlights, so to darken shadow areas in the photo, move the black-point slider to the right. Need to boost highlights? Move the white-point slider to the left. Instead of using sliders, you can let digiKam adjust levels automatically by pressing the *Auto* button. Using this feature is often hit or miss, but you can easily revert all changes using the *Defaults* button.

Three color pickers next to the *Auto* button provide yet another way to tweak levels. To adjust shadows, press the shadow color picker button and click on an area in the photo that should be black. In a similar manner, you can adjust midtones and highlights using the appropriate color pickers. Adjusting levels in the Luminosity channel can help increase contrast without affecting color saturation. To change the color balance, you can adjust levels in the Red, Green, and Blue channels (select the appropriate channel in the *Channel* drop-down list). This can be useful for boosting colors and fixing photos that suffer from unnatural color casts.

Similar to Levels, the Curves tool (*Color | Adjust Curves*) can selectively remap input tones (Figure 11), but unlike Levels, which has only black- and white-point sliders, the Curves tool can be used to control a tonal curve using any number of points.

The key element in the Curves tool is the histogram that shows the input distribution of tones (x axis) and the output tones (y axis). The left part of the x axis represents the darker tones, and the right part represents the highlights. The diagonal line (the tonal curve) indicates the ratio between input and output. Initially, the line is straight, which means that the output is exactly the same as the input. Adjusting the tonal curve alters the original ratio, thus changing the tonality of the image, and this is exactly what the Curves tool is designed to do. Click on the diagonal line to add a control point and then adjust the shape of the tonal curve by dragging the control point with the mouse. For a finer curve adjustment, create additional control points.

To better understand how curves work, start with a few basic curve adjustments. To boost highlights, adjust the top-right part of the tonal curve upward. As noted above, the right part of the histogram represents the highlights, so pushing the curve in the Luminosity channel upward increases the brightness of the image. Among other things, this technique can be used to produce a high-key lighting effect. Another common adjustment is giving the tonal curve an S-shape by raising the upper half of the curve and lowering the bottom half. This effectively brightens the lighter areas of the image and darkens the darker areas, which, in turn, increases the overall contrast of the image without affecting exposure.

Whereas the Luminosity channel allows you to adjust the tonal curve, the Red, Green, and Blue channels can be used to control the contribution of each color in specific tonal regions of the image. For example, pushing the lower part of the curve in the Red channel downward decreases the contribution of red in the dark tones, thus making shadows cooler.

DigiKam provides the ability to save the current curve profile as a preset, as well as load existing curve presets using the *Save as* and *Load* buttons in the right sidebar. The curves are stored in the Gimp-compatible format, so you can use curves created with Gimp in digiKam and vice versa.

Conclusion

In this article, I covered only a fraction of digiKam's features and functionality. Give this excellent photo management tool a try, and chances are it will quickly become your preferred tool for importing, organizing, processing, and sharing your photos. ■

INFO

[1] digiKam: *https://www.digikam.org*

[2] LibRaw: *www.libraw.org*

Firefox browser

Getting Started with Firefox

Master the most important application on your computer.

By Dmitri Popov

For most of us, daily computing is unthinkable without a browser. We use it to communicate, share, research, write, watch movies, and stream radio. In short, the browser stays in the foreground most of the time. Although plenty of good browsers are available on Linux, Mozilla Firefox still remains a popular choice on most mainstream distros, including openSUSE.

Even the most inexperienced users can learn Firefox's basics in a matter of minutes. After all, browsing mostly means typing URLs into the address bar and using the *Back* and *Forward* buttons. However, Firefox offers plenty of useful features that can vastly improve your browsing experience and make your daily computing more efficient.

Preferences and Interface

Although Firefox comes with sensible default settings, you might want to adjust the browser's options to make it behave exactly the way you want. To do this, press the hamburger menu button [1] and choose *Preferences*. All options in the *Preferences* tab are tucked under several icons in the left sidebar. Some of these options don't require any explanation, or they can be left at their defaults. However, a few useful settings deserve a closer look.

The *General* section, for example, contains options that let you control the behavior of the startup process and downloads. If you want Firefox to open tabs from a previous session, select the *Show my windows and tabs from last time* option from the *When Firefox starts* drop-down list. By default, Firefox saves downloaded files in the *Downloads* folder, but you can specify another directory by enabling the *Save files to* option and selecting the desired destination. Alternatively, enable the *Always ask me where to save files* option if you prefer to choose a different directory every time you download a file.

The *Applications* section allows you to configure the way Firefox handles specific types of content and files. For example, Firefox is set to preview PDF files using the built-in PDF viewer. If instead you want to open PDF files automatically in an external PDF reader installed on your machine, select the desired application from the drop-down menu in the *Action* list next to the *Portable Document Format (PDF)* entry (Figure 1).

The *Privacy & Security* section gives you access to all privacy-related options. Here, you can configure how the browser handles history, as well as remove saved data, such as cookies, cache, active logins, offline website data, and so on. To do this, click on the *Clear History* button in

Lead Image © Sila Nimkittikul, 123RF.com

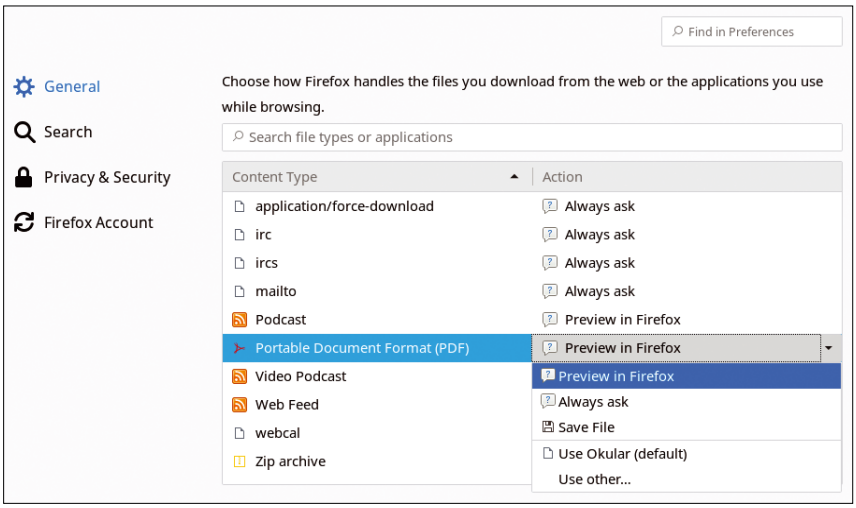

Figure 1: Selecting actions for supported content and file types.

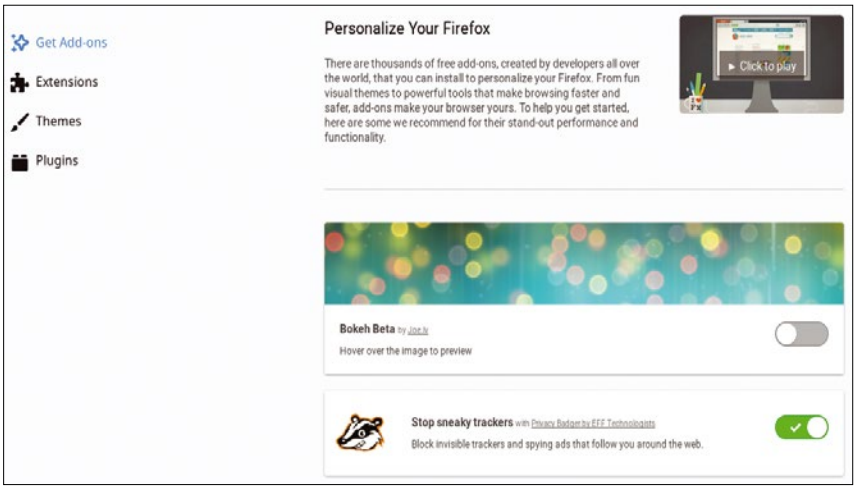

Figure 2: Choosing a theme from among the add-ons recommended by openSUSE.

the *History* section, choose the desired time range in the *Time range to clear* drop-down list, specify what type of data you want to clear in the *Details* list, and press the *Clear Now* button.

If Firefox's default plain appearance is not your cup of tea, you can dress up the browser with themes. Firefox provides a couple of choices under *Menu* | *Add-ons* | *Get Add-ons* (Figure 2). Pick a theme you like and click the slider beside it to activate it. You can manage the installed themes in the dedicated *Themes* section (Figure 3).

If you don't like any of the add-ons available on this page, navigate to the official theme repository [2], which offers a wide selection for every taste, and you can install the theme you like with a single mouse click.

Firefox also lets you customize the interface by adding, removing, and rearranging different elements like buttons, icons, and toolbars. To switch to the customization interface, press *Menu* | *Customize* and use the mouse to remove, add, and arrange buttons on the main toolbar and the menu panel (Figure 4). Press *Done* to save the changes and close the customization interface. (See the "Quick Firefox Tips" box for more info.)

Working with Bookmarks

Firefox makes it supremely easy not only to bookmark pages but also to organize and manage them. In fact, the browser offers two ways to access and manage bookmarks.

QUICK FIREFOX TIPS

Selecting text in web pages using the mouse can be rather tricky sometimes. For easier and more precise text selection, you can press F7, which toggles the so-called Caret Browsing mode. With this mode enabled, you can make a text selection by placing the movable cursor anywhere on the page and then using keyboard keys to make a text selection.

To close a browser tab, you normally click the *Close Tab* (*x*) button. Alternatively, you can close any tab by middle-clicking anywhere on it, which is slightly easier than trying to hit the tiny *x* icon.

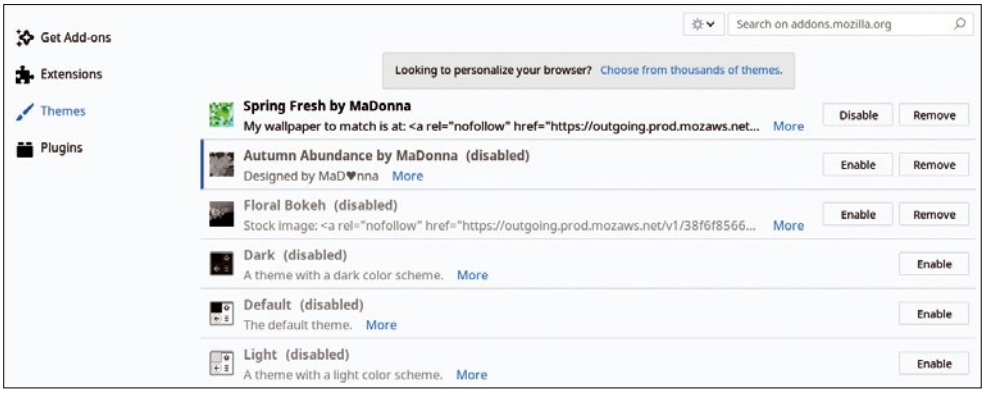

Figure 3: You can manage the installed themes in the *Themes* section.

The Ctrl + B keyboard shortcut evokes the Bookmarks sidebar, which displays all the bookmarks and folders. Using the *Search* field, you can quickly find the bookmarks matching the specified search parameters, whereas the right-click context menu gives you access to key commands for working with bookmarks. The browser also features the dedicated Library interface to manage bookmarks, which can be evoked with Ctrl + Shift + O.

The Library window lets you edit and organize bookmarks, perform restore and backup operations, and import bookmarks (Figure 5). In addition to the list of bookmarks and folders, the hierarchical tree in the window's left pane features the *Tags* node containing all tags assigned to the bookmarks; select a tag to see all related bookmarks. The Views menu in the main toolbar has two items: *Show Columns* and *Sort*. The former lets you show and hide specific columns (*Tags*, *Visit Count*, *Description*, etc.), whereas the latter can be used to sort bookmarks by different criteria (e.g., by tags, by name, by date added, etc.).

Firefox allows you to assign keywords to saved bookmarks for faster access. For example, you can assign the "lpm" keyword to the *http://www.linuxpromagazine.com/* bookmark by right-clicking the link in the Bookmarks sidebar and choosing *Properties*. The next time you need to open the bookmark in the browser, simply type *lpm* in the address bar and hit Enter.

The keyword feature can be put to some clever uses. As you might know, you can use the *define:* prefix followed by a search word (e.g., *define:monkey*) to get the word's definition in Google. If you use this feature often, you can create a special bookmark and assign it a keyword (Figure 6). The bookmark's *Location* has a *%s* at the end of the URL that acts as a placeholder – that is, it's replaced by the string you type (here, it's the word you want to look up). Using this bookmark, you can get definitions by simply typing the keyword assigned to the bookmark followed by the word you want to look up (e.g., *d monkey*).

This trick should work with any URL in which a search term can be replaced with the *%s* placeholder. For example, the *http://en.wikipedia.org/wiki/%s* URL can be used to look up words in Wikipedia, and the *http://www.linuxpromagazine.com/content/search?SearchText=%s* URL can be used to search the *Linux Pro Magazine* online archive.

Firefox Sync

If you use Firefox on multiple machines and devices, you'll appreciate the browser's syncing functionality. Once enabled, this feature

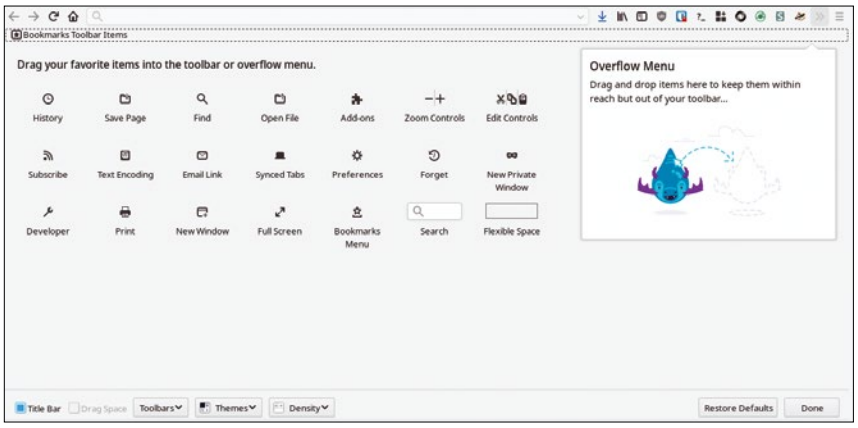

Figure 4: Customizing the Firefox interface.

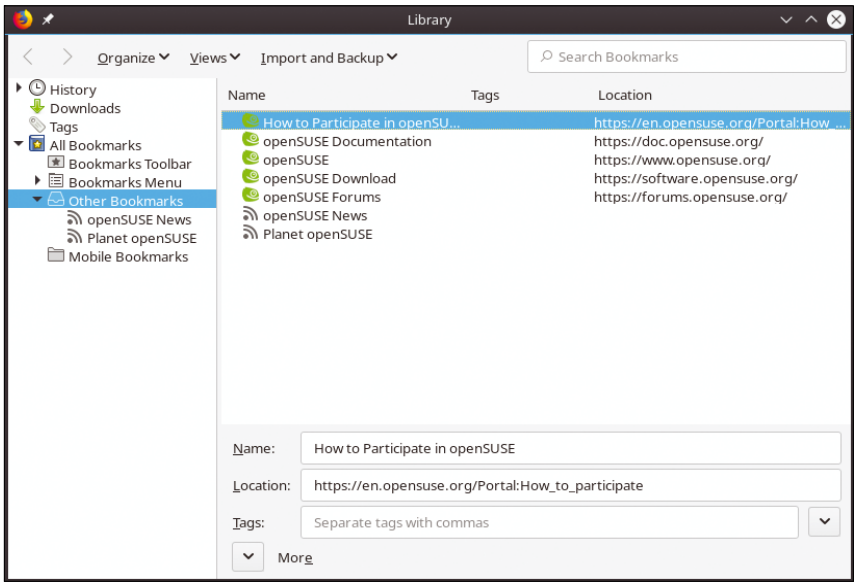

Figure 5: Managing bookmarks in the Library interface.

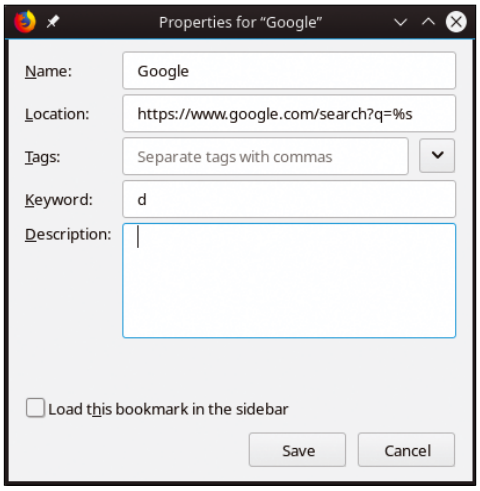

Figure 6: Creating a bookmark with a placeholder and a keyword. The *search?q=define.%s* at the end of the Google URL finds the definition of a word you enter after the keyword in the address bar.

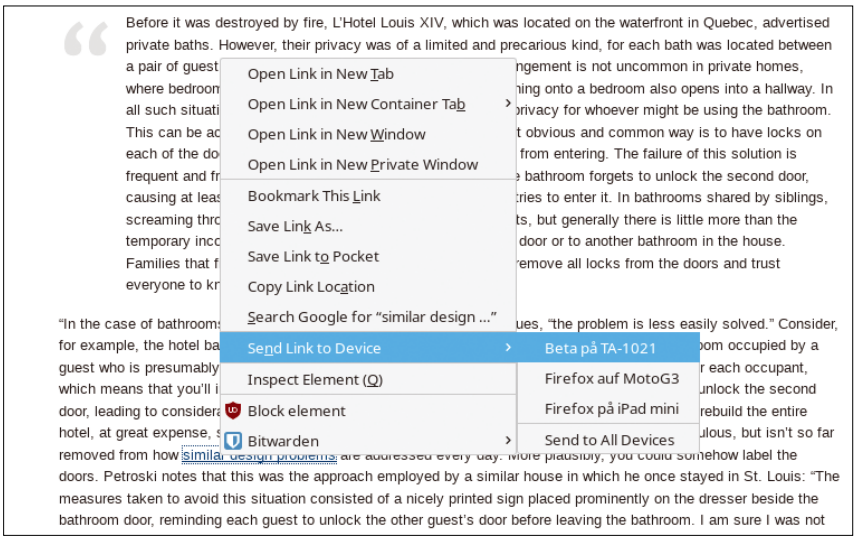

Figure 7: The Sync feature lets you send links and tabs to other devices.

PUSHING TABS AND LINKS WITH FIREFOX SYNC

Firefox for Android has lots of nifty features, but you might find one tool particularly useful. Similar to its desktop sibling, Firefox for Android supports syncing. The clever part is that this feature integrates with Android's sharing functionality, which lets you push the currently opened website to another linked machine or device. You can put this feature to many practical uses.

For example, you can use it as a read-it-when-you're-back-home tool. When you're on the move, you can push interesting links to your production machine at home. In a similar manner, you can use the desktop version of Firefox to send links and tabs to other devices linked to your Firefox Sync account (Figure 7). To do this, right-click on the tab or link you want to send, and then select the desired device from *Send Tab to Device* (or *Send Link to Device*).

keeps bookmarks, history, passwords, and tabs in sync across all Firefox installations (see the "Pushing Tabs and Links with Firefox Sync" box for more information). Enabling Sync is a matter of choosing the *Menu* | *Sign in to Sync* item. Then, you can create a new account (or sign in if you already have an account), and Firefox will sync data in the background.

By default, Firefox syncs everything, but you can change that in the *Firefox Account* section of the Preferences window. Here, you can also change the default device name and disconnect the current account from Firefox Sync.

EXTENDING FIREFOX WITH ADD-ONS

Although Firefox is a capable browser, its default functionality can be extended even further using add-ons. The official add-on repository [3] offers a vast collection of useful modules and themes. Instead of using the repository's website to browse and install add-ons, you can do this directly from within Firefox (Figure 8). Choose *Menu* | *Add-ons* and switch to the *Get Add-ons* section. Scroll to the bottom of the page and click *See more add-ons!* to navigate to the official add-on repository.

Once you've found the desired add-on, press the *Add to Firefox* button to install it. If you're not sure which add-ons to install, I can recommend a couple to get you started. uBlock Origin [4] is a must-have add-on that removes ads from web pages. Keep in mind, however, that many websites rely on ads as their primary source of revenue, so you might want to disable uBlock Origin for some domains to support your favorite online resources. If you take the issue of online privacy seriously, you should take a closer look at Privacy Badger [5], Disconnect [6], and Searchonymous [7].

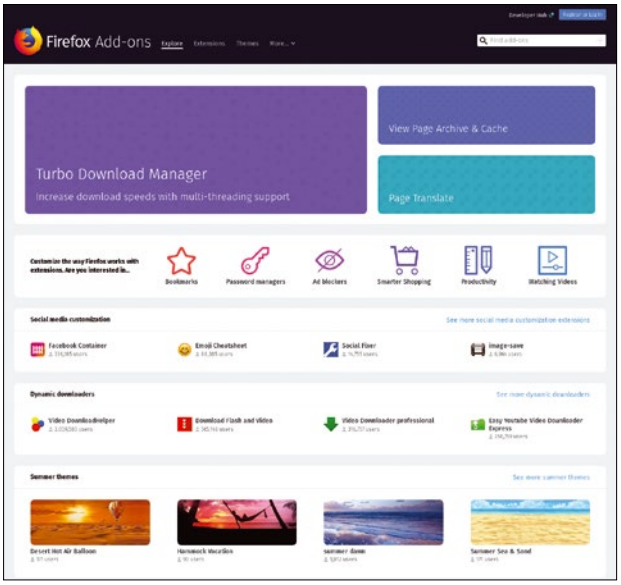

Figure 8: The official repository contains a large collection of Firefox add-ons.

FINAL WORD

Don't be fooled by Firefox's user-friendly interface: Behind its unassuming appearance lies a powerful tool that offers a myriad of useful features to make your browsing experience more enjoyable and efficient. ■

INFO

[1] Hamburger menu: *https://en.wikipedia.org/wiki/Hamburger_button*

[2] Firefox theme repository: *addons.mozilla.org/firefox/themes/*

[3] Firefox add-on repository: *addons.mozilla.org*

[4] uBlock Origin: *addons.mozilla.org/firefox/addon/ublock-origin*

[5] Privacy Badger: *www.eff.org/privacybadger*

[6] Disconnect: *addons.mozilla.org/firefox/addon/disconnect*

[7] Searchonymous: *addons.mozilla.org/firefox/addon/searchonymous*

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Using the LibreOffice free office suite

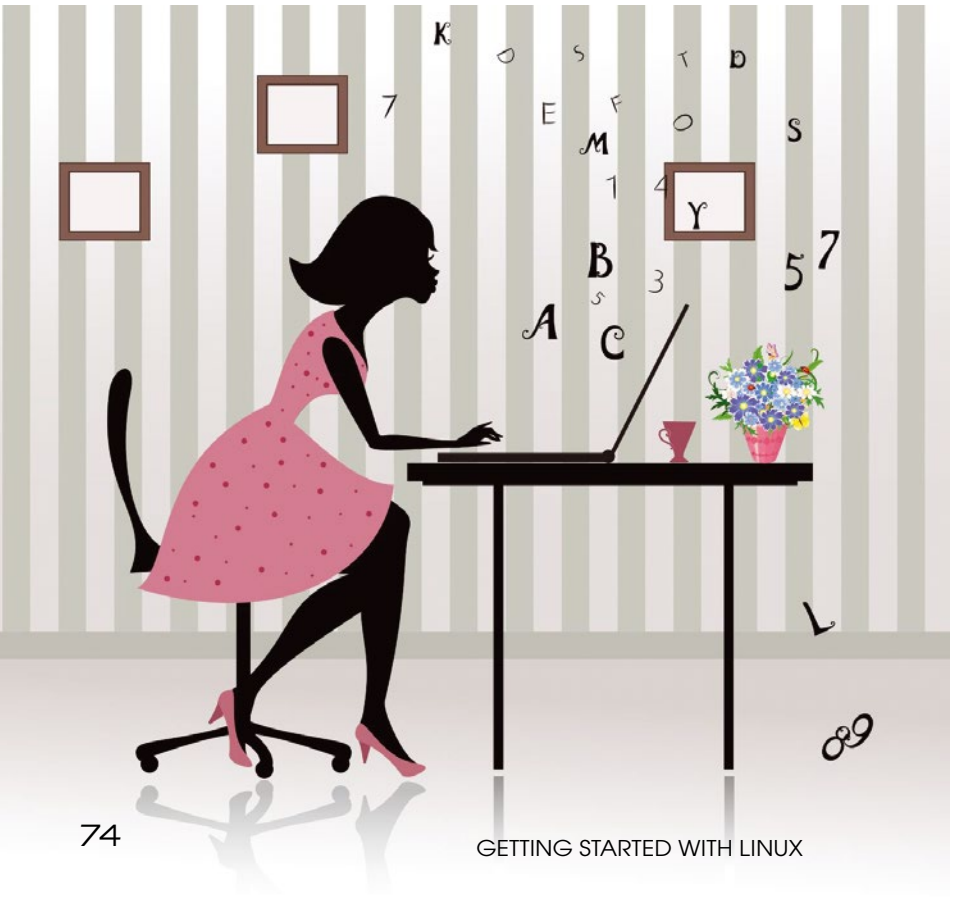
Sweet!

LibreOffice offers all the basic functionality you expect in an office suite, along with a number of features that make it really stand out. *By Dmitri Popov; revised by Bruce Byfield*

LibreOffice is a full-featured office suite comparable to and largely compatible with Microsoft Office. It is a development of The Document Foundation [1], with updated code and new features not found in Apache OpenOffice, a successor of the product by OpenOffice.org and the original open source version of Sun Microsystems' StarOffice. Here, we help you get up and running with the most commonly used LibreOffice modules: Writer, Calc, Impress, and Draw.

Introduction to Writer (Word Processor)

For many users, daily computing means writing and editing documents in one form or another, so a word processor is an essential tool. Although other word processors are available for Linux, such as AbiWord and Calligra Suite's Word, they are no match for LibreOffice Writer. It's not just a word processor – it's a desktop publisher that you can use for pretty much anything from simple letters and invoices to book design and mail merge documents.



Lead Image © Oksana Alekseeva, 123RF.com

Users familiar with other word processors will feel at home with Writer: It sports a conventional interface, and all its basic features are immediately available in the main toolbar. The Formatting toolbar gives you quick access to formatting options such as font, font size, alignment, and numbered and bulleted lists. The sidebar includes similar features, as well as access to styles and special tools like the Navigator and the Gallery for images. In other words, even if you are completely new to LibreOffice Writer, you can start using it right away. However, behind Writer's simple interface hides a rather powerful application containing a slew of clever features.

Writer, for example, includes a built-in PDF export feature that lets you generate a PDF version of your document in just a few clicks (Figure 1). To do this, choose *File* | *Export as PDF*, which opens the PDF Options dialog window that allows you to tweak the available export options. The export to PDF also now supports the Time-Stamp Protocol [2]. Besides PDF, LibreOffice supports a number of other formats, including Rich Text Format (RTF), Microsoft Word 2003 (DOC), and 2013 XML (DOCX), which can be particularly useful for people who need to exchange documents with Microsoft Office users. Keep in mind, however, that in either direction, this exchange can occasionally stumble on some complex documents containing a lot of formatting. In addition, the macros in Writer and Word are not compatible.

Like any useful word processor, Writer supports version tracking, on-the-fly spell checking, footers, headers, footnotes, tables,

and other features essential for basic and advanced word processing. Users interested in mail merge will be pleased to learn that Writer comes with a powerful, yet user-friendly Mail Merge Wizard. The Frames feature can help you lay out complex documents in Writer, and you can even use the Media Player feature to play media and insert media into documents. All these tools are indispensable, but the feature that really makes Writer stand out from the crowd is its extensive use of styles.

Styles are one of the features that make LibreOffice Writer more powerful than the average word processor. In fact, if you really want to get the most out of Writer and take your word processing skills to the next level, you should really learn how to use styles – they can save time and effort, especially if you save styles in templates for later use. The Styles feature lets you specify paragraph and character formatting properties in groups (Figure 2). For example, you can create a character style called *My bold head* (or edit the default bold character style) with the Open Sans 11pt Bold font. The next time you have to format a heading as bold, you simply apply the *My bold head* style to it.

"But, why bother creating a separate style if you can just use the *Bold* button on the Formatting toolbar?" you might ask. Suppose you have a 99-page document with dozens of words and text fragments in bold, but you need to change all the headings to bold italic. Without styles, you would have to go through the entire document and change every single head manually. That's a lot of work. With styles, performing this operation is simple: Open the *My bold head* style for editing (right-click and choose *Modify*), click the *Font* tab, select *Bold Oblique* in the Style list, and press *OK*. You are done.

The Styles feature offers a few other shortcuts as well. The *Organizer* tab in the Paragraph Style dialog allows you to specify which style should follow the current style (the *Next style* option) and from which style the current style inherits its properties (the *Inherit from* option). For example, you can create a special style for the document header and set the *Next style* option to the *Text Body* paragraph style.

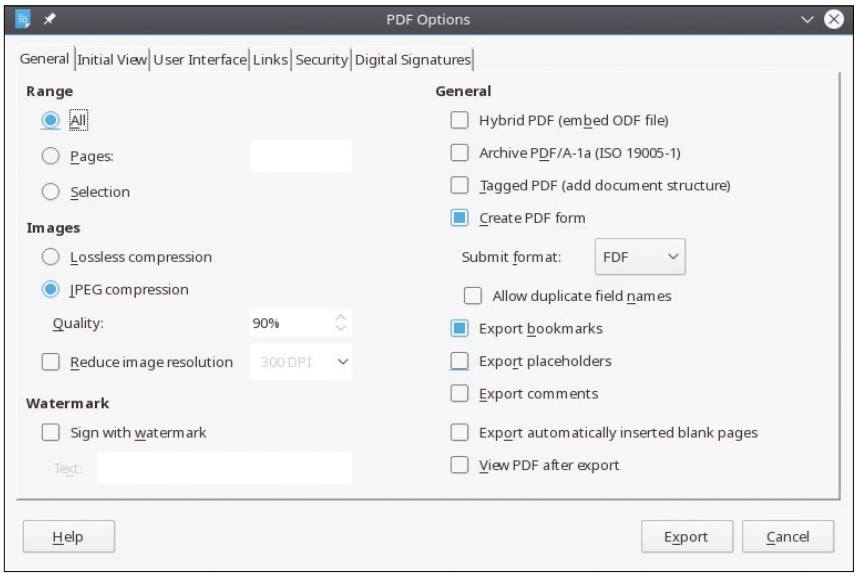


Figure 1: Save your Writer documents in PDF format with ease.

Then, when you type a header in your document and press Enter, Writer automatically switches to the *Text Body* style. The *Next style* option is especially useful if you are using multiple Page Styles, in which the predefined First Page, Left Page, and Right Page styles are automatically applied for you.

Using the *Inherit from* option, you can link several styles together. For example, by default, all the numbered *Heading* styles inherit the settings of the general *Heading* style. If you later change, for example, the font in the *Heading* style, this change is automatically applied to all the numbered *Heading* styles that inherit from that style. This way, you don't have to go through each style and change its properties manually. To keep tabs on styles, Writer also offers the Styles and Formatting tool, which can be opened by pressing the F11 key or by

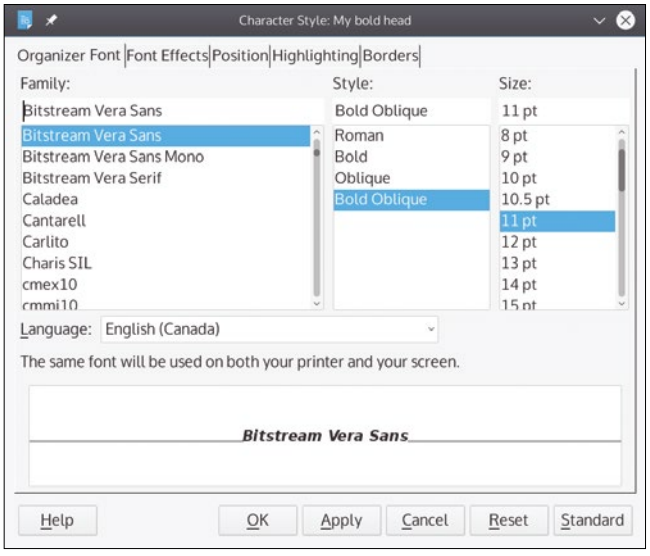


Figure 2: Tweaking styles in Writer.

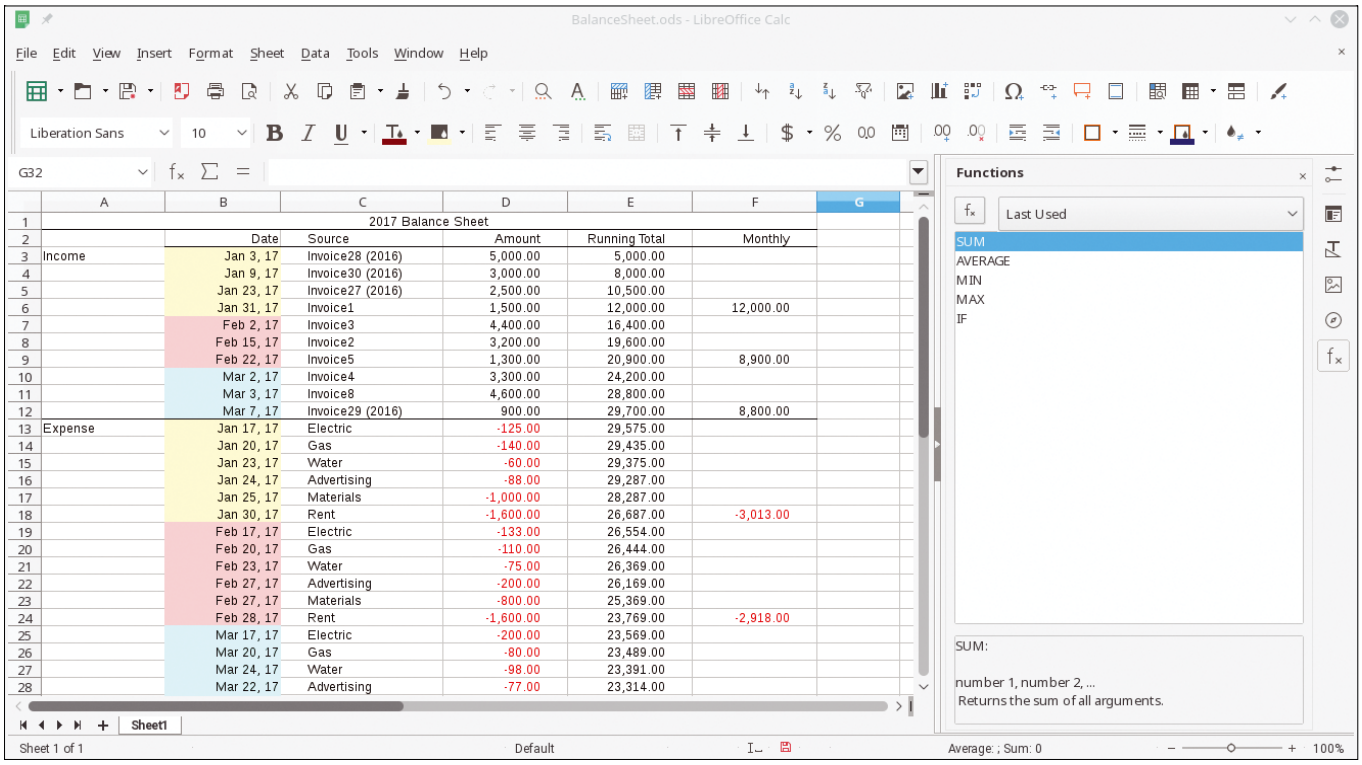


Figure 3: LibreOffice Calc in action.

choosing the *Styles and Formatting* icon from the sidebar.

Styles also give you the most convenient means of navigating through a document or of setting cross references and tables of content. They can be a bit intimidating at first, but once you've learned the ropes, they can save you a lot of time and make you look like a real LibreOffice Writer pro.

Introduction to Calc (Spreadsheets)

The LibreOffice Calc spreadsheet application has all the features you would expect to see in a spreadsheet application designed to be a match for Microsoft Excel (Figure 3). For starters, Calc offers a wide range of formatting options. Similar to Writer, Calc supports styles, which makes it easier to format both cells and any pages that you print.

Like most spreadsheets, Calc can be used either as a list or as a tool for managing and manipulating data. As a list creator, Calc has a full assortment of formatting options to color code such documents as a phone list or a project plan. Beginners especially will appreciate the ability to wrap text so that it fits inside a spreadsheet cell for easy reading. You can further refine lists by adding filters to columns to change the data displayed, as well as conditional formatting and simple display codings that allow you to see trends at a glance.

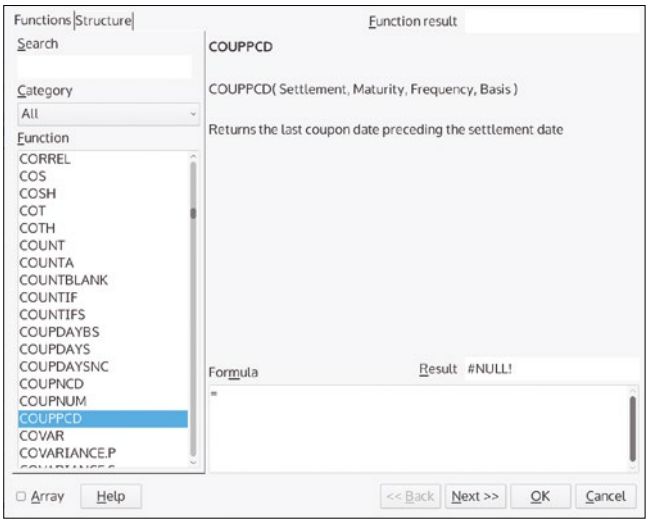


Figure 4: The best way to access functions in LibreOffice Calc is through the Function Wizard.

For more complex spreadsheets, Calc supports hundreds of functions for mathematics, statistical analysis, finances, and other purposes – including some that have options not included in the functions of the same name in Excel (Figure 4). However, for the most part, Calc's functions have similar names and options as Excel

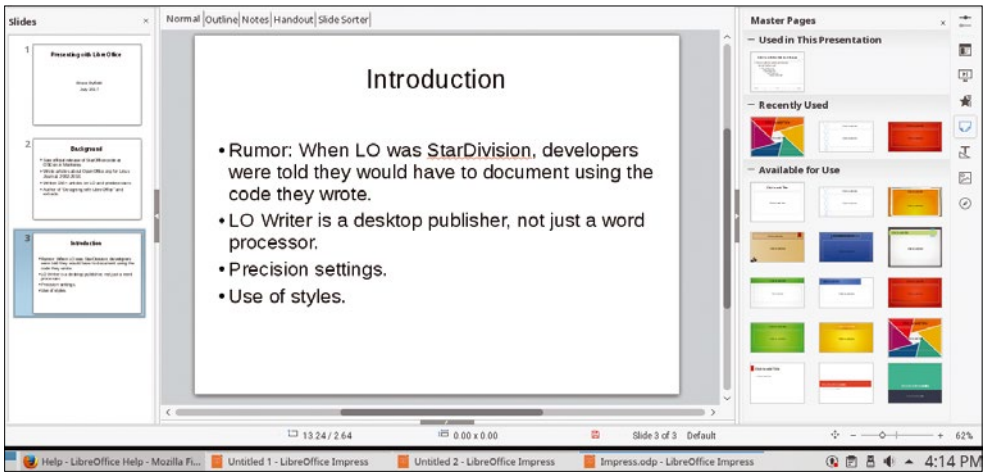


Figure 5: Impress is LibreOffice's slide show app.

functions, making imports and exports of documents easy and – except for macros – mostly seamless. These functions can be difficult to use, but the Function Wizard (*Insert* | *Function*) can not only help you to set them up, but give you error messages before you add them to a spreadsheet.

Once you have added data and functions, you can add other features. For instance, *Data* | *Validity* serves as a kind of online help for cells that require a certain type of input, while *Tools* | *Detective* helps you trace which cells are used by a function. An especially useful feature is *Data* | *Pivot Table*, which, as in Excel, allows you to cross-tabulate, summarize, and convert data in order to give you new perspectives.

These days, spreadsheets are usually used online. However, if you do want to print one, Calc includes many features to automate that task, to choose layout, and generally to make the process less irksome.

Introduction to Impress (Presentations)

When you need to create a presentation, LibreOffice Impress is your tool (Figure 5). Impress' interface is divided into three panes: the Slides pane to the left, a sidebar to the right, and the working area in the middle. The sidebar has panes for properties, transitions, animation, master pages, styles, the Gallery, and the Navigator. The working area contains several tabs (*View* | *Modes Tab Bar*) that you can use to switch between different sections. For example, in the *Notes* section, you can add notes to your slides, whereas the *Slide Sorter* section lets you change the order of slides. When you create a new presentation, you can choose from a number of templates in the *Master Pages* sidebar, or click on *File* | *Templates* | *Manage Templates* (Figure 6).

The sidebar has seven views that open from the icons on the right side of the window. These views include the default *Properties*, as well as *Slide Transition*, *Custom Animation*, *Master Pages*, and others. The *Master Pages* section contains so-called master slides, which are special templates you can apply to all slides in your presentation. As you might have guessed, the *Slide Transition* section can be used to specify transitions between slides; Impress offers quite a few effects from which to choose. In the toolbar, Impress offers an array of drawing tools (*View* | *Toolbars* | *Drawing*) that let you design diagrams and charts using tools that are also available in the LibreOffice Draw mod-

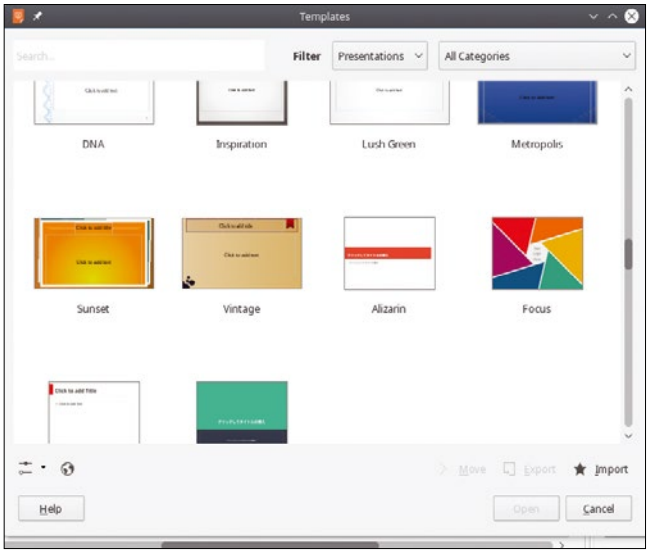


Figure 6: Selecting a master slide.

ule. You can export your presentations in a variety of formats, including PDF and HTML.

Although Impress' features and interface can seem like a lot to learn, using the application to create presentations is not that difficult. After you start Impress, select a template for the master slide from the *Master Pages* sidebar, which sets the background for all the slides in your presentation. Once you are satisfied with your slide's properties and master page (template), you may begin working on your presentation. If you later decide to change the master slide, click the *Master Pages* icon on the sidebar and choose the master you like from the Available for Use pane.

Impress offers two ways of creating slides and adding content to them. The first way is the most obvious. Right-click somewhere in the Slides pane and choose *New Slide*. You can then use the main working area to add bulleted points, graphs, and other features to the slide. Once the slide is ready, you create a new slide and work on it.

Alternatively, you can use Outline mode (click on the *Outline* tab in the working area) to manage your presentation from an outline (Figure 7). Each time you type a header and press Enter, Impress adds a new slide. Using the *Promote* and *Demote* buttons in the formatting toolbar, you can manage text as outline items. To speed things up, you can use the Tab key to demote the current item or the Tab + Shift shortcut to promote it. Outline mode lets you concentrate on the content of your presentation; you can tweak the layout and overall appearance of your presentation later.

Timing is everything in presentations, and Impress includes the handy Rehearse Timings feature that can help you adjust timings for each slide. Choose *Slide Show* | *Rehearse Timings* to launch the presentation; you should see a timer in the left corner at the bottom of the slide. Tell your imaginary audience what you want to say about the first slide. When you are ready to go to the next slide, click on the timer, and Impress saves the timing for the current slide. Repeat this step for other slides in your presentation.

Other useful tools for fine-tuning a presentation include *Slide Show* | *Custom Slide Show*, which lets you store presentations with similar content but aimed at different audiences in a single file. Also, *Slide Show* | *Slide Show Settings* fine-tunes how the presentation displays, with such options as showing the mouse during the presentation or looping continuously so that the presentation can run unattended.

Introduction to Draw (Graphics)

Despite its name, Draw is not a complete set of tools for editing graphics (Figure 8). Although more complicated work can be done in Draw, thanks to features like layers, the module is most useful for flow charts or architectural layouts. If you look at the Draw toolbar, you will find many of the basic shapes for such purposes, including connectors that allow you to connect two shapes – a feature that is especially useful for organizational charts. Also included is a small library of three dimensional basic shapes that can be rotated to display a different perspective.

Objects in Draw can be manipulated in a number of different ways. For example, you can rotate objects or flip them from left to right. You can group objects so that they are treated as a single object when you are mov-

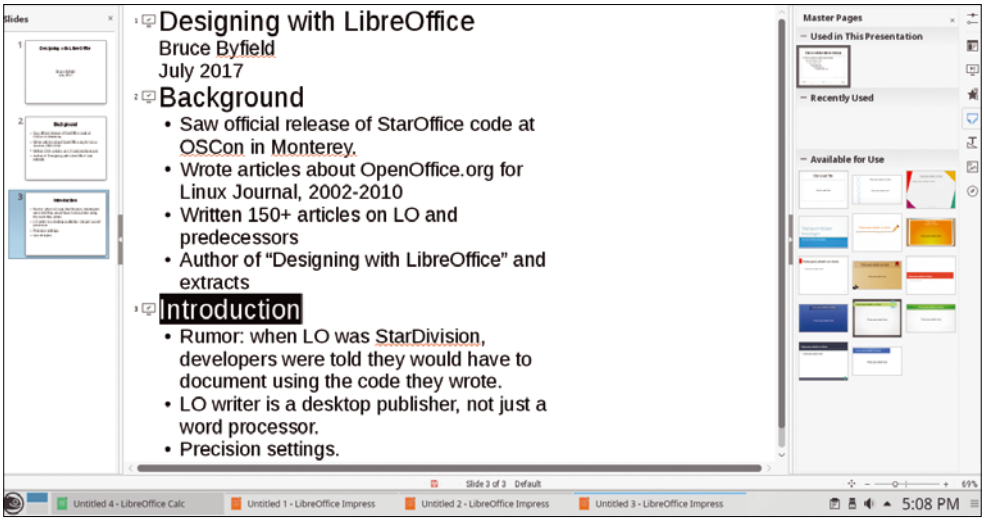


Figure 7: Outline mode is an efficient way of designing a presentation using only words.

ing them around with the mouse and edit individual objects in a group without splitting up the group. To make new shapes, you can stack them so that only parts of each object is visible.

This kind of editing is enhanced by an extensive array of settings that can be managed in styles, which reduces the need to copy or paste. At first, the range of settings may seem intimidating, but, in practice, you only need to pay attention to those relevant to each object. For example, if an object has no text, the text settings are irrelevant. Similarly, many objects will not have a shadow.

Other Draw features include Fontwork, which manipulates short pieces of text, and a built-in scanner, which allows users to import scans directly into Draw.

As you work in Draw, you may notice that the editing window closely resembles that of Impress. The similarity is no accident – the two modules share much of the same code. In particular, the left-hand pane displays multiple slides or pages – a feature often missing from graphic editors. Combined with Draw's ability to use text frames, its multipage capacity makes Draw a simple but effective layout app as well.

Other Modules

Write, Calc, Impress, and Draw are not the only modules available in LibreOffice. The suite also includes Base, a flexible graphical database that can be used as a data source for Writer and Calc. You can also use Charts from other modules to create graphs and pie charts. For the mathematically-minded, there is an equation editor (*File* | *New* | *Formula*) and wizards for creating simple documents and creating merge documents, such as identical letters addressed to different recipients.

In general, if you have used an office suite before, you should be able to find the features you expect in LibreOffice. They may have different names or be positioned in different menus, but usually they are there.

If not, then, as with Firefox, you can add new features to LibreOffice applications using extensions. The best place to find LibreOffice extensions is in the official extension repository [3]. Here, you can find extensions for all LibreOffice applications, complete with ratings and comments.

Installing LibreOffice extensions is straightforward. To begin, you have to download the desired extension; then, launch LibreOffice, choose *Tools* | *Extension Manager*, press *Add*, and select the downloaded `.oxt` file. Once the extension is installed, restart LibreOffice to enable it. Which extensions you choose to install on your system depend largely on your needs, but popular extensions include an improved search tool, sets of templates installed as a group, and language dictionaries for spell checking and hyphenation. A complete list of extensions, including those added during installation, is available from the Extension Manager.

All of this is a lot to absorb, but well worth the effort of learning. Take the time to explore LibreOffice and to get to know it, and it will serve you well. ■

INFO

[1] The Document Foundation: *http://www.documentfoundation.org*

[2] RFC 3161 Time-Stamp Protocol: *https://www.ietf.org/rfc/rfc3161.txt*

[3] LibreOffice extension repository: *https://extensions.libreoffice.org*

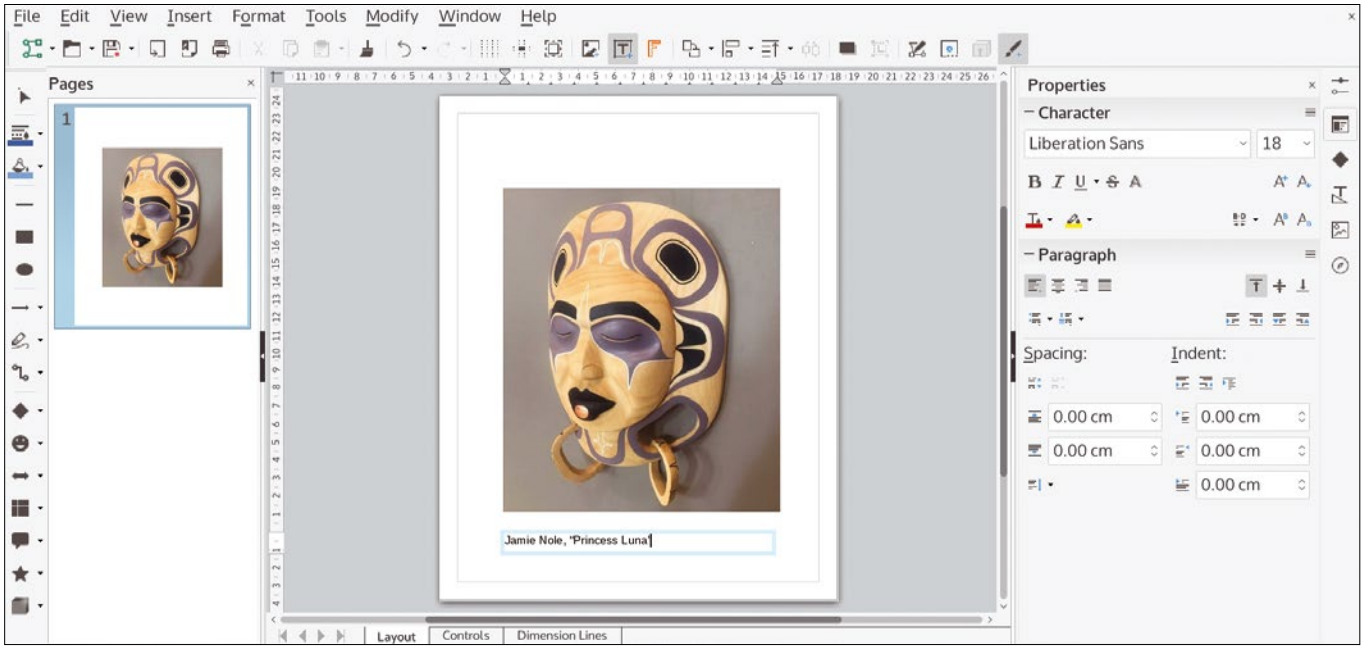


Figure 8: Draw does not offer a complete set of graphic editing tools.

Expert photo processing with Gimp

Picture Perfect

Touch up your digital images with the Gimp image processing tool. *By Patrick David*

Today more people than ever can take great digital photographs inexpensively, and that means more people than ever have a need for high-quality image processing software. The GNU Image Manipulation Program (GIMP or Gimp) [1] is a great free tool you can use to process your digital photos. Gimp can easily handle even the most demanding photo retouching tasks.

First Look

When you open Gimp, the first thing you'll notice is a collection of separate floating windows scattered across your screen. To make your first steps a little easier, it might help to take advantage of "single-window" mode (*Windows* | *Single-Window Mode*), which ties all the components together in a single window. This option remains enabled through subsequent restarts of Gimp.

The main Gimp window (in single-window mode) is shown in Figure 1. Notice the following important components:

- Canvas – The display area where your image appears and where you will be doing all your image editing.
- Toolbox – The box on the left side (outlined in red in Figure 1) with all the available tools for adjusting your image. The toolbox is your primary interface to the majority of the tools.
- Dockable dialogs – The boxes on the right side are where you will see many of the different dialogs available in Gimp. Some of the most common dialogs manage tool options, layers, and histograms.

Lead Image © Iveta Aleksandrova Angelova, 123RF.com

Every tool included with Gimp has associated options. A Tool Options dialog on the left displays the available parameters, which differ depending on the active tool.

Cropping

One common task is to create a new image that contains a smaller portion of the original image. Often you will notice an undesirable element in the original, or you might want to "reframe" the image for some visual effect. Cutting out unwanted parts of the image is known as "cropping."

To crop an image in Gimp, simply define the area you want to keep and tell Gimp to discard everything else. Use the *Rectangle Select* tool to make a rectangular selection of the area you want to keep, then crop the image to fit that rectangle.

The *Rectangle Select* tool is the first item in the toolbox. (When you click on it, your cursor in the image canvas will change to indicate the tool you are using.) You can also access this tool through the menus by choosing *Tools* | *Selection Tools* | *Rectangle Select*.

To select a region on your canvas, left-click at one corner of your selection area and drag the cursor to the opposite corner. You will see a visual outline of the rectangular selection you are making (Figure 2). Don't worry at this point about choosing the perfect point – you can quite easily modify the selection boundaries after defining the area. Once you've reached the opposite corner, release the left mouse button, and your selection will have a marching dashed line surrounding it.

To fine-tune or modify the selection boundary, mouse over one of the selection corners. You will notice the corner "box" turns yellow. Left-click and drag the corner to reposition it. As you drag the corner, notice that the opposite corner keeps its position. You can also mouse over any of the four edges of the selection, and the edge behaves similarly.

If you mouse over anywhere else inside of the selection, the cursor adds a multidirec-

tional arrow to its tip. You can now left-click and drag to move the selection around the image canvas.

As mentioned previously, it's important to pay attention to the available options for each tool, and the *Rectangle Select* tool does have some helpful ones (see the box titled "Select Tool Options").

Once you have a selection for your new crop, choose *Image* | *Crop to Selection* to crop the image.

Rotating an Image

Unless you're shooting on a tripod (or have a fancy digital level built into your camera), some of your images might turn out just slightly out of level. Or, you might want to rotate your image for purely artistic purposes. Whatever the reason, you can easily rotate an image in Gimp.

Select *Tools* | *Transform Tools* | *Rotate* to activate the *Rotate* tool. After it's selected, simply click anywhere on your image. You should see that your image is now overlaid with a grid (Figure 4), and a dialog box appears to give you further control over the rotation (Figure 5). If you happen to know the specific value you want to rotate your image, simply enter the value directly in the input box.

You might not know the exact value most of the time and might prefer to rotate the image manually. To do so, simply click and drag anywhere on your image canvas. As you drag your mouse, the image rotates. Once the image is rotated to the desired position, simply press the *Rotate* button in the dialog.

In some cases, it might be difficult to align features in your image to be precisely horizontal or vertical. Luckily, it's easy to drag guides onto the canvas to give you a visual reference. Simply left-click in any of the rulers along the top or left of the canvas. You will see a guide that you can position by simply dragging it onto your canvas. Use the guide as a reference while rotating your image.

Once the rotate operation finishes, you might notice corners with gray checkerboard patterns that have no image data. The checkerboard represents transparent areas. To clean up the results after rotating, simply use the methods discussed in the previous section to crop the image down to fit the rotation.

Correcting Levels

Occasionally an image could use just a little extra adjustment to the exposure levels. Gimp

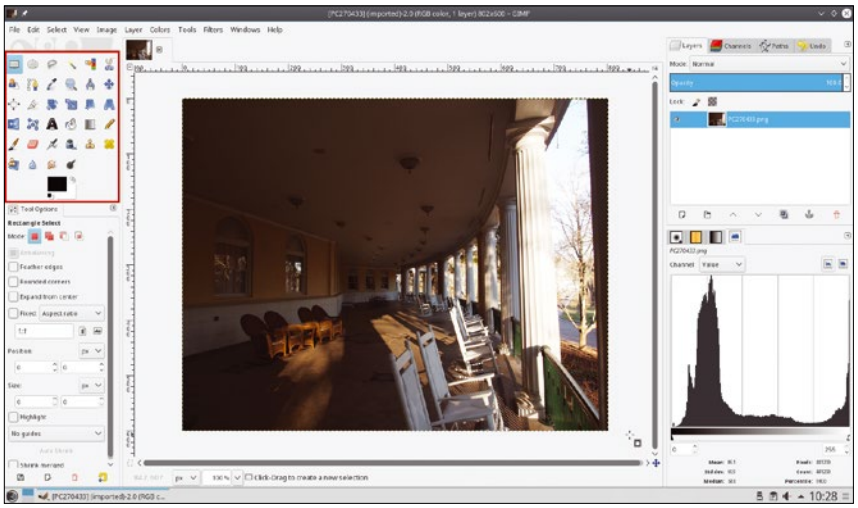


Figure 1: The main window in single-window mode.

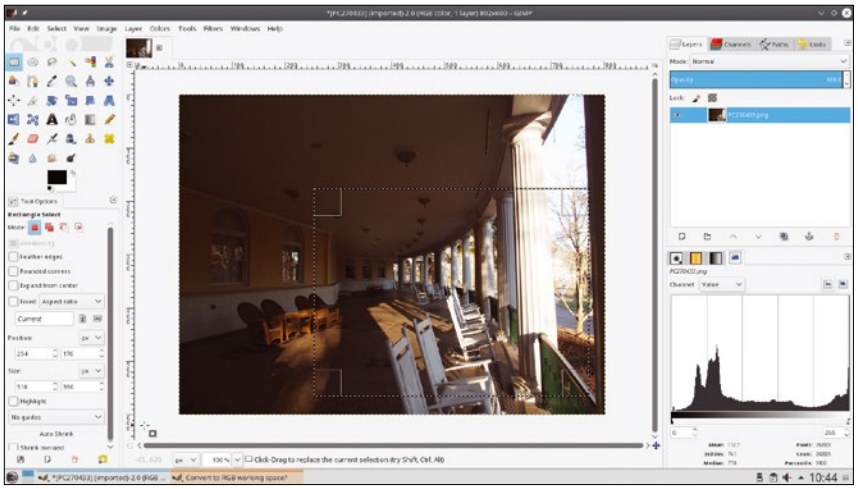


Figure 2: Selecting a region of the image.

lets you modify the lightness of an image, as well as the contrast (relative brightness between objects). If an image appears a bit "washed out" (low contrast) or you want to reduce the harshness (high contrast), level correction can help mitigate these problems and breathe life back into your images.

Gimp offers three main ways to adjust image levels: *Brightness-Contrast*, *Levels*, and *Curves*. The following sections introduce these important correction techniques.

Adjusting Brightness and Contrast

The easiest method for adjusting the brightness and contrast of an image is to use the Brightness-Contrast dialog (Figure 6), which you can activate by choosing *Colors* | *Brightness-Contrast*.

The control available through this dialog is very basic, with one slider for brightness and another for contrast. This method might work for simple adjustments, but it is limited by the simplicity of the controls.

SELECT TOOL OPTIONS

To help you visualize what the selection will look like isolated from the rest of the image, enable the *Highlight* option. Highlighting darkens all of the image outside of your current selection (Figure 3).

Gimp can also overlay guides on the selection area to help you compose. Some common guides include *Center lines*, *Rule of thirds*, and *Golden sections*, as well as some less common guides, such as *Diagonal lines* and *Rule of fifths*.

You can also specify an aspect ratio for your image that will then remain constant regardless of how you resize the selection. Simply enable *Fixed* beside the *Aspect ratio* drop-down and change the value in the input box to your desired ratio. For instance, if you want a square crop, you could simply enter *1:1* in the input box. If you want something to fit your widescreen monitor, *16:10* might be what you're looking for. Perhaps you'd like to emulate the aspect ratio of widescreen cinema movies. In that case, you could try *2.40:1*.

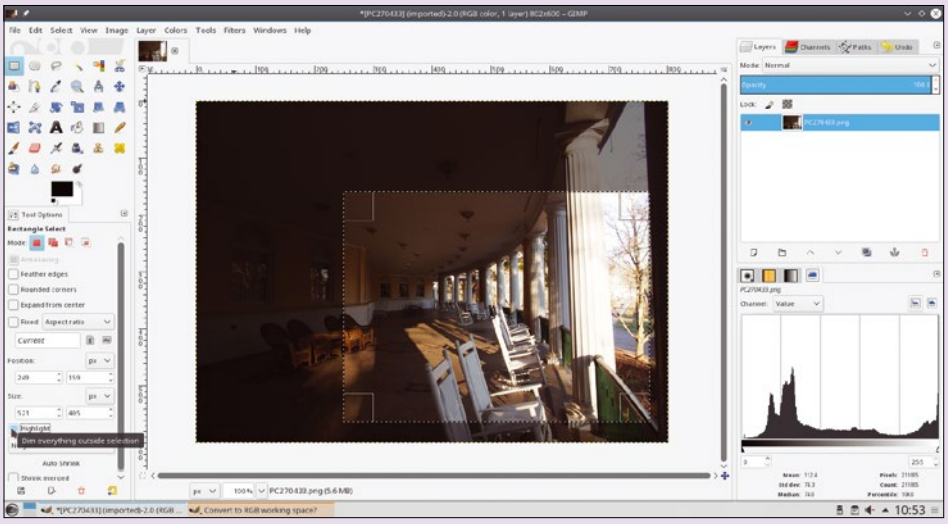


Figure 3: The *Highlight* option darkens the region beyond the selection area.

ADJUSTING COLOR LEVELS

A better method for adjusting brightness and contrast with a little more control is the Levels dialog (Figure 7), which also offers some automation options. To activate this dialog, go to the menubar and select *Colors* | *Levels*.

The Levels dialog gives you a better view of your image values through a histogram, offering finer control over the values across the image. The Input Levels portion of the dialog allows you to control the values of the image for the final output. This area shows a histogram of the image, which is a representation of all the pixel values in your image from black (left) to white (right). If your image is very dark, you will see a peak on the left side of the histogram; a mostly light image shows the opposite, with a peak to the right.

At the bottom of the histogram are three arrows that represent where the black, middle, and white tonal values should be. By default, the three regions will encompass the entire image range from 0 (black) to 255 (white), with the mid-tones at 1.00. Take note of the eyedropper buttons for black and white values in the input boxes below.

The Output Levels slider represents how much of the available range of tones you want in your final output. Tone ranges are less commonly used when adjusting levels.

The All Channels portion of this dialog has four buttons. For many images, it is worth trying a quick fix with the *Auto* button first, which automatically adjusts the image levels to span the entire range. Gimp usually does a pretty good job initially at setting values that can improve some images (particularly for "hazy" or low-contrast images).

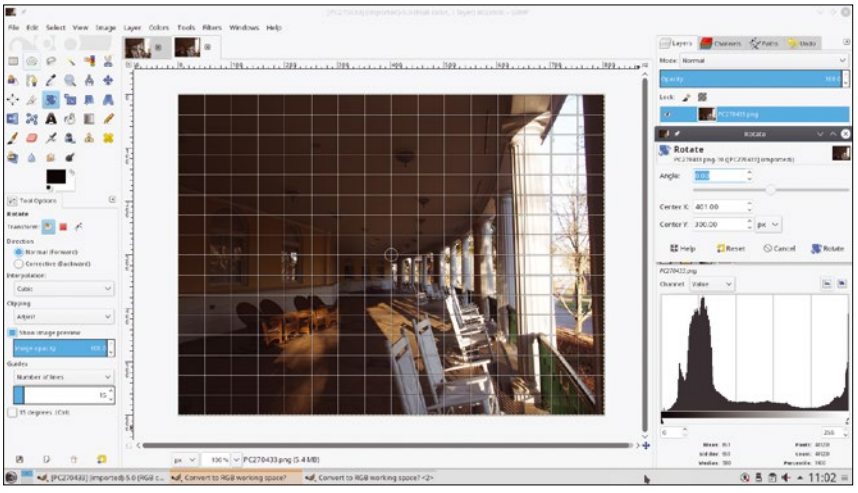


Figure 4: When you choose the *Rotate* option, a grid appears to help you align your image.

The three eyedroppers represent – left to right – black, gray, and white pick points. Click on an eyedropper to activate one. The mouse cursor will change to an eyedropper on the canvas; you can then manually click on an area in the image that represents what you want (i.e., click on an area that should be black with the black eyedropper). Gimp will shift the image values for you automatically.

The gray point eyedropper is particularly handy if your image has a little bit of a color cast to it (because of poor lighting or white balance). If you know that an area of your image is truly color-neutral, you can use the gray point eyedropper to select in that area. In some cases, this technique can help correct color casts automatically.

If the adjustment using *Auto* doesn't produce the desired result, you can press the *Reset* button at the bottom of the dialog and try other methods. Try using the eyedroppers to indicate the black, gray, or white points manually, or you can adjust the Input Levels sliders. The arrows under the histogram will allow you to modify the values.

If you need to increase the black values in the image, simply pull the black triangle to the right (and the opposite for white values). The slider for the middle values (gray) adjusts the contrast of the image. Moving it to the left decreases contrast, and moving it to the right increases it.

Some users focus on the histogram in the Input Levels portion of the dialog, which gives a visual representation of the distribution of values across the entire image. You will (usually) want to have the full range of input values mapped to the output. You can drag the black point slider to the apparent bottom of the histogram, and the same for the white point, to compress the range manually to fit your input.

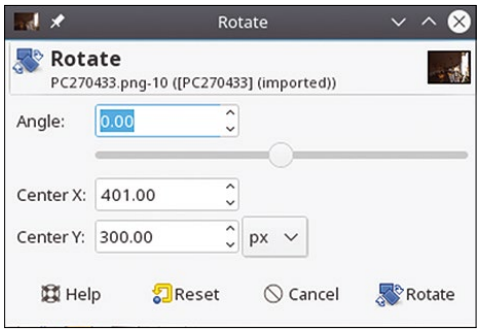


Figure 5: The Rotate dialog lets you specify the angle and center of rotation.

Figure 6: The easiest way to adjust contrast is with the Brightness-Contrast dialog.

Adjusting Color Curves

The most powerful options for adjusting image tones is in the Curves dialog (*Colors* | *Curves*), but the extra power also requires a deeper understanding of light and contrast in an image.

The Curves dialog displays a histogram with a line running through it diagonally (Figure 8). Clicking anywhere on the graph adds a node to the curve that you can left-click to drag around. Clicking again somewhere else adds another node, and so on (by default, Gimp interpolates a smooth curve).

The lower (x) axis of the graph represents your image data values from black (left) to white (right). The left (y) axis of the graph represents the output after you make changes, from black (bottom) to white (top). The best way to visualize the histogram from left to right is as dark, medium, and light areas of illumination (Figure 9).

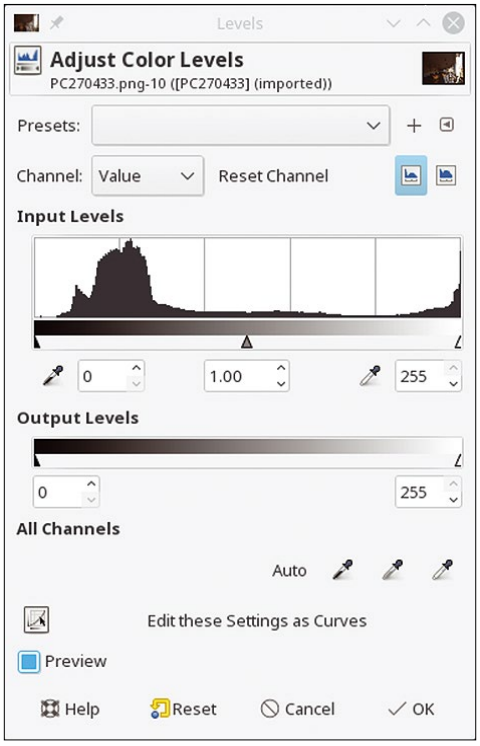


Figure 7: The Levels dialog offers more options for controlling light and color levels.

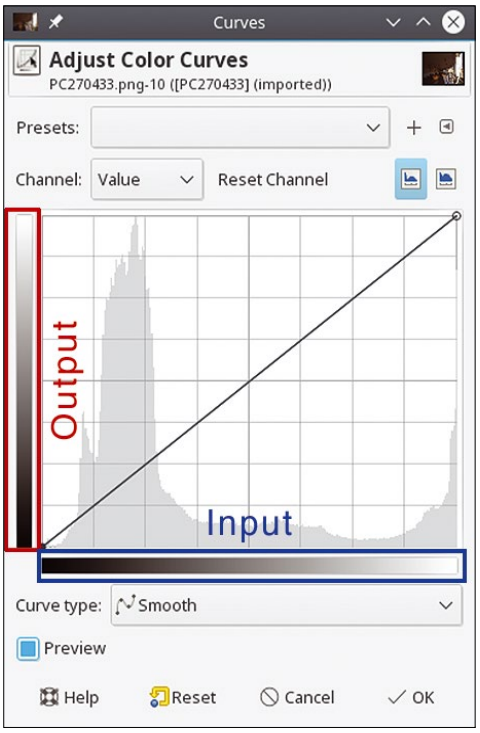


Figure 8: The Curves dialog lets you modify the ratio of input to output levels in a continuous curve.

By dragging nodes around on the curve, you change the corresponding values as either lighter (moving up) or darker (moving down). To increase the contrast of an image, you need to increase the difference between dark and light tones. Put another way, you need to make the darks darker and the lights lighter, which you can accomplish by creating an S-shaped curve.

To decrease the contrast, simply do the opposite. Adding more nodes on the curve to isolate specific tone regions gives you a large amount of control over the entire range of image values. Experimentation is the key to success.

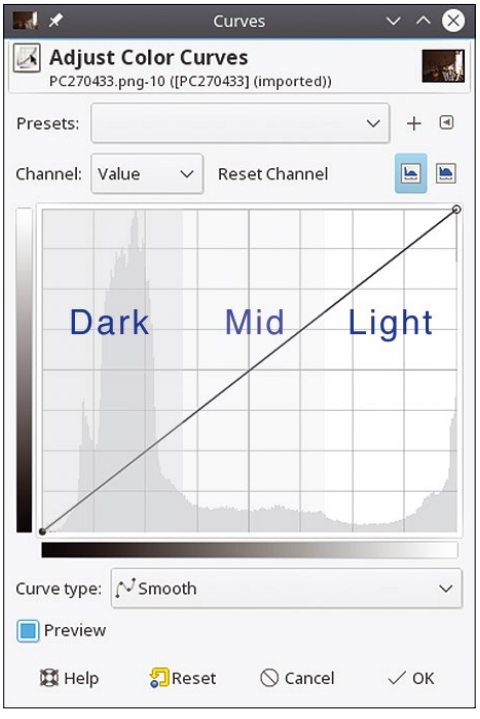


Figure 9: Think of the Curves dialog as a histogram representing dark, mid-value, and light regions of illumination.

RESIZING

Often you need to change the size of an image, particularly for sharing through email or social networks. Chances are, the default file dimensions from a modern digital camera are too large to use directly online.

Gimp lets you resize the image to dimensions more suitable for sharing. (Gimp is also capable of enlarging the image, but you will notice a reduction in quality very quickly. In general, it's often best to avoid enlarging images.)

If you want to scale the entire image on your canvas to a different size, the easiest way is to use the *Image* | *Scale Image* command, which invokes the Scale Image dialog (Figure 10).

If you know one of the pixel dimensions you require, you can simply enter it into the *Width* or *Height* field of the dialog. By default, width and height are locked to maintain the same aspect ratio, which will prevent unintentional stretching or compression.

Also by default, the values shown in the dialog are for the pixel dimensions of your image. Using the selection box next to the dimension input boxes, you can change the input to other types of values: percent, inches, millimeters, and so on. The dimensional values will also depend on the resolution you desire (e.g., pixels or millimeters).

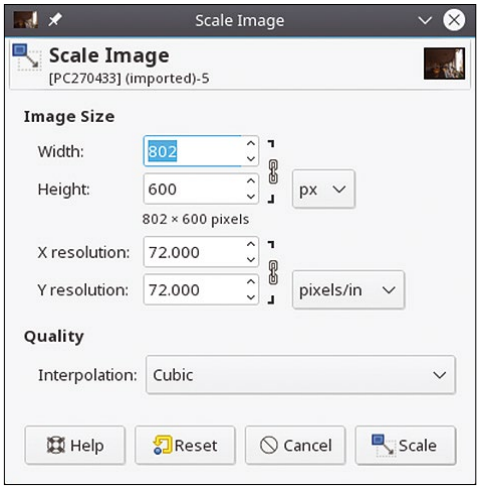


Figure 10: Change the image size with the Scale Image dialog.

Scaling an image down is a lossy operation (i.e., image information is lost) because pixels must be discarded to fit the new dimensions. Gimp offers a few different Interpolation methods to use during the scaling operation. The *Sinc (Lanczos3)* method is the best option for most cases. If you aren't sure which type of interpolation you need, stick with *Sinc*.

Sharpening

Some images can use a bit of sharpening to help make features just a little more crisp. Because of the destructive nature of sharpening, it's often best left as the last step in any workflow.

A default installation of Gimp includes two methods for sharpening an image, *Sharpen* and *Unsharp Mask*. To activate the Sharpen dialog, select *Filters* | *Enhance* | *Sharpen* (Figure 11). A single slider adjusts the strength of the sharpening effect. The problem with sharpening in general is that, not only will it enhance edges, it will also enhance any digital noise or defects in the image.

The use of a tool called *Unsharp Mask* sounds counterintuitive to the goal of sharpening an image, and indeed the sharpening effect is derived from first blurring the image (the opposite of what you want to achieve). The *Unsharp Mask* operation increases contrast across features of a certain size using a blurred copy of your image. To open the Unsharp Mask dialog, select *Filters* | *Enhance* | *Unsharp Mask*.

The dialog window (Figure 12) shows a small preview of your image (zoomed to 100%) and has three option sliders for adjusting the effect: *Radius*, *Amount*, and *Threshold*.

Radius tells Gimp the distance from an edge (pixels) in which to begin using the sharpen effects. *Amount* adjusts the level of sharpening, and *Threshold* defines the minimum difference (pixels) to an edge in which sharpening is applied.

The default values are a good starting point for sharpening an image. If some adjustments are required, adjust the *Amount* and *Radius* values. (*Threshold* can usually remain at its default value.) A good rule of thumb with sharpening is to use less than you think you need. Over-sharpening can produce ugly artifacts and unrealistic results.

Saving and Exporting

Gimp has adopted a simple methodology for saving image data. It is best to *Save* your image in the native Gimp XCF file format and *Export* to generate other image formats. Gimp's native XCF file format is the best format for saving *all* relevant Gimp data (layers, blend modes, channels, etc.) with the image. To save your workspace, select *File* | *Save*.

The Save dialog asks you to choose a location and filename. One interesting trick to use in this dialog is to append `.bz2` to the extension, which automatically compresses the file to save disk space.

Although saving in the Gimp native format ensures that you won't lose any Gimp-specific data, the downside is that you cannot view the image without Gimp. To place the image in a standard format used with other tools, select *File* | *Export As*.

The Export Image dialog is similar to the Save dialog, except that you can choose different types of image files in which to export. You can see a list of all the supported file types by clicking *Select File Type (By Extension)* at the bottom of the dialog. If you know the type of image extension you want to use, just type it in the *Name* input box.

If your intention is to post the image online, the most useful format is probably JPEG (`.jpg`), because this format will give you great compression while retaining good visual quality.

After clicking *Export* and before the file is exported, Gimp presents a set of parameter options. The most important parameter is *Quality*. Moving the quality higher will result in a better looking image, but the trade-off is a larger file size. A good compromise is often in the range 90-95.

Conclusion

The simple tasks shown in this article are just the tip of many wonderful things you can accomplish with Gimp. With almost 20 years of development, Gimp has matured into an extremely capable image editing program, and you'll find abundant resources for exploring its capabilities even further. Check out the Gimp Registry [2] for an entire ecosystem of scripts and many wonderful plugins (including the extremely helpful G'MIC [3]).

For further tutorials and reading, check out Meet the GIMP! [4], as well as my own Gimp tutorials [5]. ■

INFO

[1] GNU Image Manipulation Program: *http://www.gimp.org/*

[2] Gimp plugin registry: *http://registry.gimp.org/*

[3] G'MIC: *http://gmic.sourceforge.net/*

[4] Meet the GIMP!: *http://meetthegimp.org/*

[5] Pat David's blog "Getting Around in GIMP": *http://blog.patdavid.net/p/getting-around-in-gimp.html*

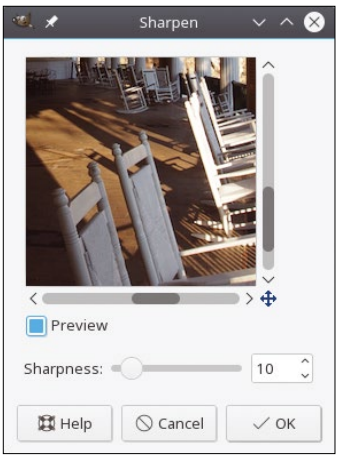


Figure 11: The Sharpen dialog offers a single slider for increasing sharpness around edges, producing a crisper image.

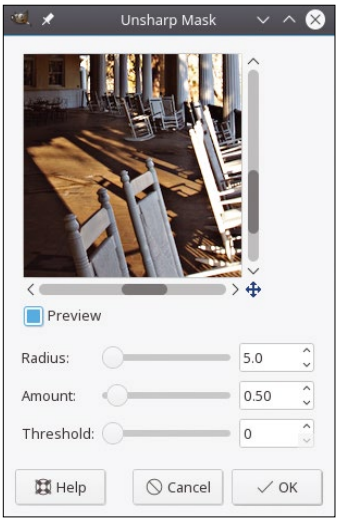


Figure 12: The Unsharp Mask dialog offers a more powerful (but more complicated) option for sharpening.

3D games with and without Steam

Full Steam Ahead

Linux systems are well suited for general computing and software development, but when it comes to gaming, most people prefer Windows. Current 3D games with and without Steam support show that Linux is suited up and ready to play.

By Hartmut Noack; revised by Claudio Cambra

Modern 3D games under Linux used to be challenging even before the first round of play, with tricky settings in Wine or installation of its commercial version, Cedega. Crude hacks in the settings files required that gamers have a high level of experience with Linux. Numerous strange bugs kept appearing in the games, but the game providers didn't care, because they occurred only on Linux, a strange niche operating system, instead of the officially supported Windows platform.

Lead Image © Anton Brand, 123RF.com

The year 2010 saw changes in this unpleasant state of affairs when some game developers started turning to Java as an operating-system-agnostic development language. Mojang's Minecraft enjoyed outstanding success as an independent title, running under Windows and Linux almost equally well – some even said it ran better under Linux. Around the same time, the game provider Valve decided to develop hardware in addition to its Steam digital distribution gaming platform [1]. When deciding on an operating system for their Steam Box gaming console (later, the Steam Machine), Valve chose Debian Linux. One of the many reasons for this choice was probably that highly technical 3D games native to Linux already existed at the time. The first-person shooter Sauerbraten has been demonstrating since 2003 that a gamer can manage to roam smoothly around 3D landscapes, fight, and die under Linux.

Additionally, the Valve managing director and cofounder Gabe Newell was deeply disappointed with Microsoft Windows 8. He described it as a catastrophe for the PC as an open system for gamers and issued urgent recommendations for a change to Linux [2]. In the middle of 2018, the Steam's search function [3] reported that more than 3,000 games on the Steam platform officially ran under Linux (Figure 1). At the same time, development of native Linux games has forged ahead, and some of these games are also available with a free license. I tried out two Steam offerings under Linux – Cities: Skylines [4] and ARK: Survival Evolved [5]. I also tried 0 A.D. [6], which is a native real-time strategy game with a free license. The

"Test Equipment" box details the hardware used in the tests.

If you want to play Steam games, you have to register on the Steam website and then download and install the Steam client for Linux. The entire registration procedure comprises just a few steps and asks only for an email address, password, and username. Ideally, you can specify a telephone number that can be used in the event of problems to verify the account, but this is not needed most of the time. If you forget your password, Steam will send the data necessary for a reset to the registered email address, just as other providers do.

STEAM ON OPENSUSE

Installing Steam on openSUSE is as easy as typing

```
zypper in steam
```

as a superuser in the terminal. This installs the Steam client on the computer across the entire system. In our testing (openSUSE Leap 42.3), the client would not open up on the first try – all that was required in order to fix this was opening a terminal window and running

```
LIBGL_DRI3_DISABLE=1 steam
```

All of the games acquired with Steam are located in each user's home directory, installed in the hidden `~/.steam` directory. All of the game data, such as configuration files, game scores, and mods, are found in one folder. You can start some of the games without a Steam client directly from this storage location; however, it only works for those few titles that have abandoned restrictions on the right to copy. (See the "Steam and DRM" box.)

If you see the SteamOS icon (Figure 2) next to a game's name, you know the game can be played on Linux. The SteamPlay icon means you can buy it once, and it also will work on other platforms that the game supports (i.e., if you see the SteamPlay icon, it must also show the SteamOS icon to work on Linux).

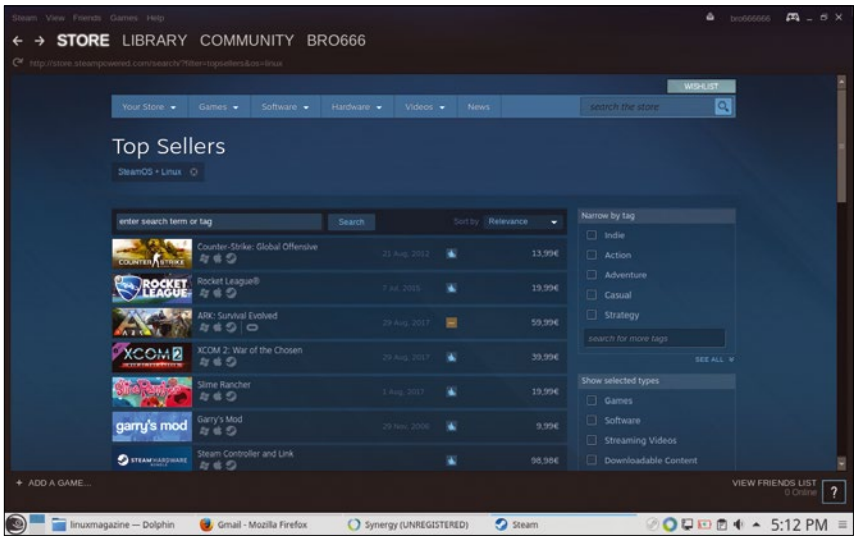


Figure 1: Steam offers its own search category for Linux-capable games. Presently ARK is one of the best sellers.

To purchase games sold for a fee, you need a credit card or a PayPal account. Other payment alternatives include direct withdrawals from your bank account or prepaid cards that can be purchased in stores. Also, you might find store locations where the games, like products from Google Play and iTunes, can be purchased. The

Figure 2: The SteamOS icon appears on the openSUSE desktop after installation. This icon associated with a game title indicates it runs on Linux.

TEST EQUIPMENT

I wanted to find out how modern video games work under Linux on computers that users would consider completely average. I used a Lenovo IdeaPad laptop with an Intel Core i5 CPU and 8GB of working memory. It was equipped with an Nvidia GT 620 graphics chip with 1GB of shared memory. The other machine was an Intel Core i5 desktop PC with 8GB of RAM and an Nvidia GeForce GTX 750Ti graphics card with its own 2GB of memory. Both computers are normally used as standard Linux PCs.

STEAM AND DRM

Digital Rights Management (DRM) technology is a mechanism that could more aptly be called Digital Restrictions Management. This technology assumes control over a user's access to files on their own computer and over various hardware interfaces, particularly those involved in transferring data to audio and video cards and the accompanying output devices. Proprietary kernel modules for Nvidia and AMD graphics chips support parts of this technology, and applications like Steam rely on it. This situation has led to increasingly strident criticism being leveled by the Linux world against the Steam developer Valve.

It is only fair to add that Valve advised game providers early on to stay away from DRM. Connecting DRM files to a system's hardware is done as a means of directly controlling loading and processing of the data, but it requires significant computing outlays. Instead of taking this approach, Steam's Custom Executable Generation (CEG) is based on a connection between the software and the user account. The advantage for users is that this technology does not reach into the system; it stays within the game software that Steam sells. It can only be called up when connected through a Steam account. This makes it both possible and permissible to install the software on multiple computers. However, the approach does not allow multiple simultaneous starts from different computers. Each time the user switches to a different computer, it becomes necessary to enter a security code that Steam has sent by email.

The final point to address is how the user plays when no Internet access is available. During testing, both of the games from Steam functioned normally without an Internet connection. Steam offers an offline mode, and the games I tested started as expected. With ARK, you can even start a local undedicated server; of course, there is only one visitor. Those looking for Steam games that have no copy restrictions whatsoever will find several titles that can be played without starting the Steam client. However, the platform does not officially offer support for these games. On the other hand, they are not subject to the copy protection mechanism employed by Steam or the annoying DRM technology. The Wikia page [7] devoted to Steam contains a list of these games. The caveat is that only about a third of the titles mentioned are suitable for Linux.

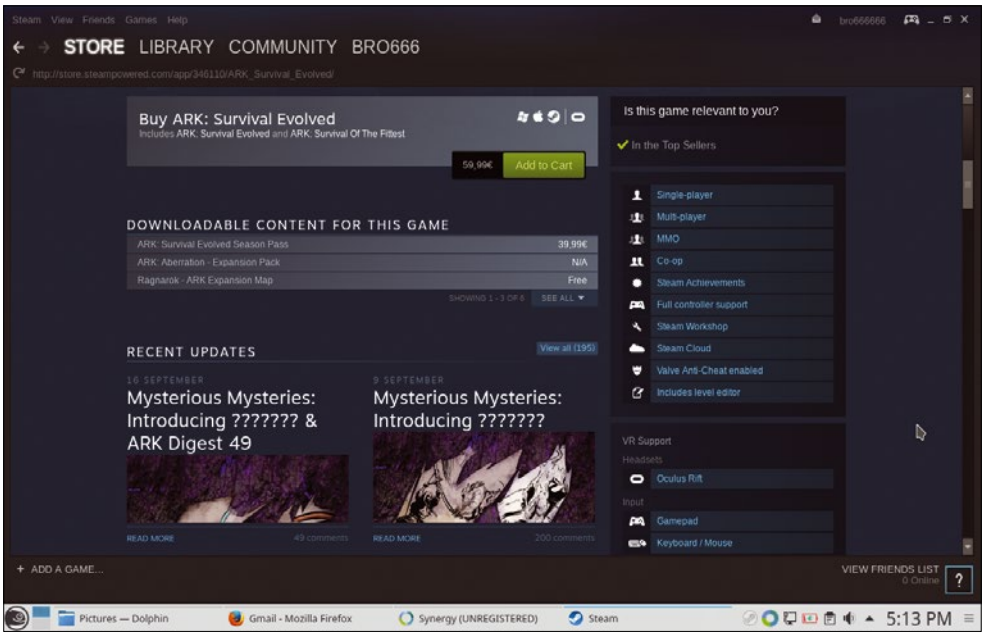


Figure 3: Steam gives detailed information about ARK's content and the Steam features it supports, such as the Steam Workshop or virtual reality headsets. The SteamOS logo indicates official Linux support.

Steam client requires a login when called for the first time. Thereafter, the program starts without asking for a password.

Steam works well across platforms – which you'll notice in the fluid displays – even though it was built for Linux-based hardware. However, the program is not presented as a piece of software that is deeply embedded in the Linux desktop. For instance, it ignores system language settings and always loads in English. Steam activates an icon in the system tray that hides a menu you can access with a right-click. It contains an option for *Settings* where you can easily change languages. This right-click menu is also the only place to go to end Steam. Closing the main window only ends its own module, but the back end continues to run.

The Steam shop is convenient and free of clutter. The search function comes with a list that includes simple icons and short descriptions. One click in the list displays the game's page together with a demo and useful information about the system requirements. Two clicks with the mouse suffice to buy a game (Figure 3). The game then appears in the profile, but only in the list of purchased items.

To download the game, click on the *Install* button, which will proceed to install the game in your home directory. If the procedure is canceled, Steam will first check the size of available memory. If the partition fails with the home directory, Steam offers to install the game on a different data storage device. It can take a little while to complete installation. For example, the download size of ARK: Survival Evolved is almost 60GB.

Figure 4: Wilderness and wild animals make ARK a thrilling experience.

ARK – Paleo Survival Deluxe

This huge download is a promise of things to come. ARK recently came out of its early access beta phase. Studio Wildcard has designed the game with fantastic attention to detail. Even the landscape looks remarkably genuine, and the 200 plus animal species that populate the landscape have been created with the standard of artistry found in epic movies like *Jurassic Park*. Their artificial intelligence has also been programmed with a love of detail that makes for an incredibly

convincing experience of interactions that occur among the animals themselves and between the animals and the gamer (Figure 4).

The only thing that jerks the gamer back into reality is the motion animation, which is sometimes bizarre. Despite the game being "finished," numerous bugs and glitches remind the player of its "early access" phase. For instance, a Parasaurolophus stuck halfway under a boulder can go into a continuous loop of strange contortions. The mixture of survival, adventures, and sandboxes is

MULTIPLAYER

The tribes in ARK and the parties and alliances in 0 A.D. emphasize a shared experience. Therefore both games were built from the beginning as client-server systems. This is very different in Cities: Skylines, in which the original concept was to create a single-player game by design. The chief developer Mariina Hallikainen explained in a 2015 interview with *PC Gamer* [8] that no multiplayer mode was in the works.

Hundreds of servers host ARK worlds, most of which are found in the Nitrado [9] network, a gaming platform on which official servers are centrally maintained by Studio Wildcard. As a result, this platform always has the most recent version of a game, which you need to install on the client side. The official servers use The Island and The Center maps for the gaming environment [10]. Mods are not supported. Private servers often offer additional maps, and they allow mods. Studio Wildcard expressly supports the construction of independent servers.

The system requirements can be somewhat daunting, including, at the minimum, a 64-bit Linux system with 8GB of working memory and an Intel Core i5 quad-core processor. This weeds out the possibility of spending a nominal amount to rent a virtual server that suffices, for example, for five to six Minecraft gamers. To lower the entry barrier, Studio Wildcard offers to rent preconfigured servers. As a rule, these are less expensive than other servers that would be suitable for the game. Studio Wildcard also offers free downloadable software packages for operating the servers. The packages are based, like ARK itself, on Unreal Engine's Shooter Game [11].

Even the basic ARK for home use, operating as a local undedicated server, offers the possibility of inviting additional players. During testing, it quickly became apparent that it is necessary to have a desktop computer. Tests on the laptop showed it was possible to generate a connection to the local server, but in the process of doing so, it used half of the 8GB of RAM. Moreover, the `top` CPU indicator showed a load of around 150 percent, causing the fan to run at top speeds. Time outs and the heavy load made it clear that a standard PC gaming computer is preferable for participation in these kinds of games.

Currently, 0 A.D. has neither server infrastructure nor a dedicated server version. Instead, the server starts itself. For this to happen, you should call *Multiplayer* / *Multiplayer Lobby* from the menu (Figure 5), where you can host a game or join rounds with other players. The lobby is not full of visitors, but if you can wait around for a few minutes, other players will appear. The host player waits in a configuration view for other players who are waiting to begin rounds of single-player games.

The settings for network play are selected in exactly the same way as they are for single-player mode, which means the host can discuss the settings for the game in chat sessions and create alliances between players and their preferred team members. Multiplayer mode also exhibits the developers' professionalism. The only issues that dim the luster a bit are small bugs in the game mechanics. All of the important elements work flawlessly – online, as well.

Figure 5: All of the maps and options found in single-player mode are also available in multiplayer mode. The host assigns team members to alliances and gives them civilizations.

nonetheless appealing. Those who proceed strategically and learn which animals can be hunted and which animals are better avoided advance quickly. Most of the animals can be tamed with a little experience. When one of the living fossils is stunned and then fed, you get a non-player animal that transports, loads, defends you against other monsters, and takes you on a ride through the wilderness.

I observed a limited number of technical problems during 700 plus hours of play. Occasionally the game falters, but it always returns to very normal and smooth operation within a few minutes. Occasionally the animation does not work properly, but this problem is limited to particular areas of the playing field on The Island. Online servers let you experience adventures collaboratively. The play there often proceeds at a brisk pace. In addition to standard play modes – player versus player (PvP) and player versus elements (PvE) – a primitive mode only permits the use of stone tools. (See the "Multiplayer" box.)

In PvP mode, human gamers play against one another either as individuals or in so called ARK "tribes." The idea is to see who can dominate the playing field. In PvE mode, gamers try to protect themselves against the elements, either by working alone or collaboratively. The elements include monsters and other dangers. Cooperation is permitted, but gamers are supposed to avoid animosities.

ARK ran smoothly on the PC with GTX 750Ti graphics. When the settings are moderate, it has sophisticated textures and anti-aliasing. The game was just barely playable on the IdeaPad laptop, and then only with graphics settings that make a carefully designed game look like an experiment from the 1990s (Figure 6).

Therefore, if you are on the go and want to see tame dinos eat, you can make do with a mobile system. However, the real fun comes with more power. The various modes and extensions also need a system with more vigor, because they include multiple super-monsters and entire maps. Since mid-May 2016, an especially detailed map, The Center, has been available as an official ARK add-on.

Cities: Skylines – The Mayor's Office

Cities: Skylines is a complex city-building game that has demanding hardware requirements. It is somewhat more complicated to play, but less adventurous, than ARK. Like the classic game with a similar name, the goal is to establish a city in a landscape of choice and build it out beginning with an exit on an interstate. The inhabitants pay taxes that can be used to construct all kinds of power stations, streets, police stations, and other infrastructure. This then attracts more inhabitants to the city, who generate

Figure 6: The textures appear flat, and the horizon is small on a laptop with the GT 620 GPU; however, the low-resolution settings make it possible to play the game on slower systems.

more revenue, thus making it possible for the city to grow in size.

In addition to the game itself are editors for scenarios and gameplay elements. The game creator, Colossal Order, offers Cities: Skylines via the publisher Paradox Interactive, who also runs the community portal (Figure 7).

The many different possibilities are so well structured that even a first grader can have fun constructing a city. However, children who want to play should be able to read with comprehension, because some of the ingenuity of the game depends on being able to understand detailed explanations provided in the tool panels. A player also needs to pay attention to the chat messages sent by the city's inhabitants to the player, their mayor. These communications report successes, but they also point to problems that are easy to overlook in the complex general overview (Figure 8).

Cities: Skylines did not run well at all on a laptop. Just the start time itself lasted as long as a quarter of an hour. With a desktop PC, on the other hand, the game booted in testing without any problems after four or five minutes – much like ARK. The camera view affords an especially impressive perspective, in which the player can observe the city with photorealistic graphics.

A good city planner can begin to govern a city with 10,000 inhabitants after just 10 to 15 hours of play time, bearing in mind that fascinating construction and infrastructure elements continue to increase in number. Of course, all of this comes with interesting problems, such as environmental damage, over-indebtedness, and similar issues, thus challenging game players' intellectual capabilities.

Cities can be expanded with numerous mods available from the Steam workshop. In addition to many environmental challenges, such as snow and rain, you have to contend with terrible catastrophes that include a volcanic eruption.

0 A.D. – Classical Antiquity in Modern Times

Unlike the two Steam titles, the open source game 0 A.D., developed by Wildfire Games, at first looks like it lacks complexity. However, first appearances can be deceiving. This is not a project put together by a hobbyist during off hours. In fact, 0 A.D. offers the most important of the properties usually found in professionally developed games: The concept is well thought out, and it has been carefully implemented. Nothing about 0 A.D. is purely experimental. Everything that has been implemented works perfectly and makes a thoroughly professional impression.

On their mailing list, the developers discuss things like the appearance of the sandals worn by Roman Legionnaires some 2,050 years ago, and whether the shooting range of the Iberian slingers has been accurately portrayed when they are presented in the game as a deadly danger for advancing Persian warriors. Even the historical names given to the champion non-player characters (NPCs) in the game are unknown to most because *Asterix*, a Franco-Belgian comic that

Figure 7: From the game's Home screen, you set up an account on the Paradox Interactive portal. On the right, you can see the long list of Steam expansions available for the game.

Figure 8: A municipal finance department is one of the many administrative gameplay elements found in Cities: Skylines.

Figure 9: The gameplay in 0 A.D. is not squeamish when it comes to different groups of people assaulting each other. As soon as the NPCs get started, bloody corpses start appearing on the playing field.

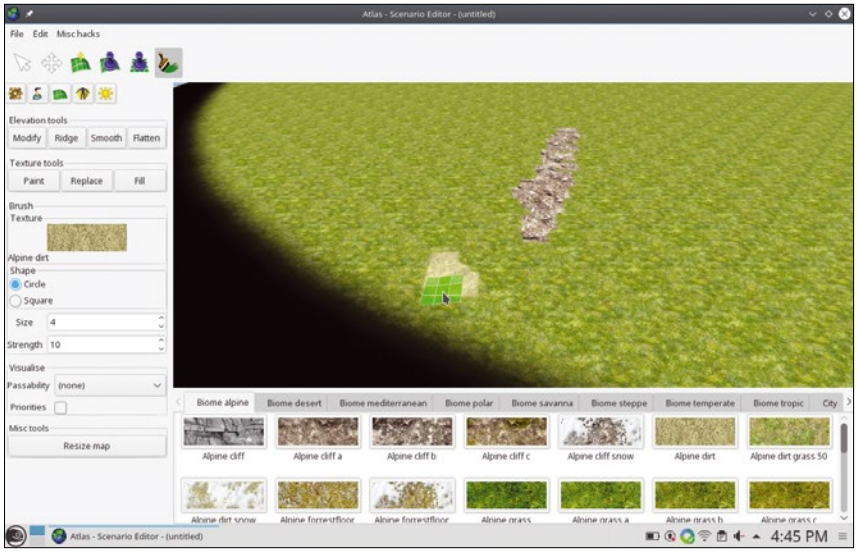


Figure 10: Atlas, the scenario editor in 0 A.D., lets you create custom playing fields for 0 A.D. and edit the available maps.

ran from 1959 to 2010 [12], is the sole source for much of the knowledge about this time period. The attention to detail is fun for fans of classical history and contributes significantly to the game's rich atmosphere.

The game's basic themes are economy and conflict. Ethnic groups like Persians, Celtic tribes, Greeks, and Indians construct houses, fields, and forts in unspoiled environments according to legendary and historical records. They then have to struggle against other groups controlled either by online players or from the remarkably more powerful artificial intelligence (Figure 9). Testing did not reveal any technical problems, and 0 A.D. was the only game tested that worked well and delivered well-rendered graphics on a laptop with a 600 generation Nvidia card. The game did slow down noticeably with scenarios that had more than three game partitions as soon as the number of NPCs was greater than 500.

0 A.D. is definitely less spectacular and less complex than the two Steam candidates, but I had no complaints in terms of how it handled. The current version comes with a conquest mode that makes the battles between the groups more interesting and adds excitement to the clashes. The website contains directions for building mods and scenarios and instructions for character design in the Blender graphics program (Figure 10).

Conclusions

Nothing stands in your way of playing a challenging video game on Linux. None of the games tested here showed any defects attributable to the operating system. However, each of the candidates requires current, proprietary drivers. Two of the games, ARK and 0 A.D., can function to a large extent with free Nouveau drivers. For ARK, these drivers do cause serious restrictions, though. 0 A.D. has far fewer restrictions. All of the games tested are worth the purchase price, because it really does pay to spend time with them. ■

INFO

[1] Steam: *http://store.steampowered.com/*

[2] Gabe Newell interview: *http://www.theverge.com/2013/1/8/3852144/gabe-newell-interview-steam-box-future-of-gaming*

[3] Games for SteamOS and Linux: *http://store.steampowered.com/search/?term=&sort_by=_ASC&os=linux*

[4] Cities: Skylines at Steam: *http://store.steampowered.com/app/255710/*

[5] ARK: *http://www.playark.com/*

[6] 0 A.D.: *https://play0ad.com/*

[7] Steam games without DRM: *http://steam.wikia.com/wiki/List_of_DRM-free_games*

[8] Mariina Hallikainen interview: *http://www.pcgamer.com/cities-skylines-greenlit-after-what-happened-to-simcity/*

[9] Nitrado: *https://server.nitrado.net*

[10] The Center: *https://ark.gamepedia.com/The_Center*

[11] Unreal Engine's Shooter Game: *https://docs.unrealengine.com/latest/INT/Resources/SampleGames/ShooterGame/*

[12] Asterix: *https://en.wikipedia.org/wiki/Asterix*

Emulating classic gaming consoles in openSUSE

Ancient Heroes

Many computer games from the 1980s and 1990s enjoy cult status. Graphics and sound were not very advanced back then, which forced the producers to impress gamers with good ideas and a convincing level of design. Emulators let you run those classic games on a Linux PC.

By Marko Dragicevic; revised by Claudio Cambra

If you wanted to play video games 25 years ago, you would typically attach a small box to the TV in your family room. It was either a game console or a handy home computer, and you used a gamepad or joystick as a controller. With the right software, you can do all this and more in openSUSE: Fans can even try those old DOS games again.

Play Time

Thirty years ago, PCs with the then-popular MS-DOS operating system did not really feel as if they were made for fun. However, resourceful game developers tweaked the limited graphical capabilities to the max; over the years, the graphics cards of the time increasingly displayed more colors. Millions of people spent many hours trying to save the world in the Commander Keen platform game, or they engaged in dangerous battles in Doom. Now, DOSBox [1] lets Linux run DOS games.

You can easily install DOSBox in YaST. Before starting, however, create a subfolder in your own home directory into which you then copy the desired games. To do so, enter

```
mkdir ~/DOSGAMES
```

in the console. After running DOSBox (you'll find its launcher in the *Lost & Found* section of the start menu), you can type

```
MOUNT C ~/DOSGAMES
```

at the emulated DOS command line, which makes a fictional `C:` drive available to your DOS software collection. If you no longer have any old DOS games, you can buy them cheaply at flea markets or on *gog.com* [2]. Gog buys up old licenses and provides the corresponding classical software as a download for just a few dollars.

Lead Image © EKATERINI GIANNOUTSOU, 123RF.com

Fast Adventures

PC owners during this time period really loved the point-and-click graphic adventure genre. Classics such as Monkey Island and King's Quest often told humorous stories in which the protagonist needed to solve puzzles. If you like this genre, you can also use the ScummVM emulator [3] (Figure 1) instead of DOSBox. ScummVM works with

games that rely on internal interpreters rather than machine-level language, a practice of game developers at that time (e.g., LucasArts and Sierra).

Open source programmers used reverse engineering to discover the structure of the coded interpreter files and developed their own player in the form of ScummVM. If you now want to use, for example, a retro MS-DOS adventure game, you don't have to emulate the complete DOS PC (which could be too slow in some places, especially with more complex games). Instead, you just copy the game files to the ScummVM subdirectory, which offers native and thus smooth and fast adventure playing.

ScummVM is also installed at the push of a button in YaST. Some adventures that cost serious amounts of money 20 to 30 years ago have now been released by their former developers as downloadable freeware [4]. This is true of classics such as Beneath a Steel Sky and Flight of the Amazon Queen. Games from LucasArts and Sierra are also available as free downloads, at least as demo versions, and the full versions will only cost you between $1 and $5 on *gog.com* or eBay.

More Platforms

Some installable game console emulators require you to add SUSE's *Emulators* repository to your system. To do this, enter the commands shown in Listing 1 in a terminal window.

Now you can install a variety of emulators. The most important one is set up with the command:

```
sudo zypper in nestopia zsnes ↵
  vice gens mame
```

You now have the most interesting retro consoles and home computer emulators on your PC. Gens emulates not only the Sega Genesis, but also its hardware extensions, Sega CD and Sega 32X, if needed. Purchasing them used to be an expensive proposition, but now any user can emulate all of this for free and see how game developers tweaked additional hardware power out of the system back then. Games like Sonic the Hedgehog, in particular, are likely to remind many users of the days when Sega still made devices.

Nestopia and ZSNES emulate the NES and SNES Nintendo consoles and are guaranteed to be a hit with Super Mario fans (Figure 2). MAME is a special case: This software emulates the hardware of various arcade gaming machines. You will likely be familiar with the most famous games: Asteroids and Galaga. VICE emulates the Commodore 64 home computer (Figure 3), which was made famous by entertainment classics like California Games.

Game Sources

Games for ScummVM and DOSBox are quite easy to find: In part, as described above, you can simply buy them as download licenses and then copy the game files into the directory for the corresponding emulator. This process is somewhat more complicated for old consoles and home computers: Software for Nintendo and Sega devices, for example, was delivered on hardware cartridges; home computers used a datassette or a 5.25-inch floppy drive.

Few people are likely to have the appropriate hardware to read the game code directly and copy it to their PC. On the Internet, several

Figure 1: ScummVM emulates adventure classics such as Sierra's Police Quest 3.

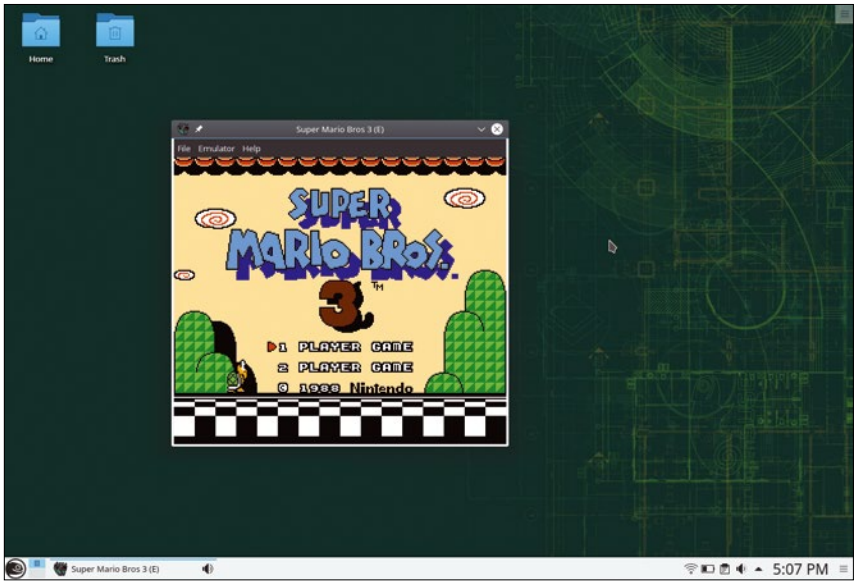


Figure 2: An NES emulator in "windowed" mode.

LISTING 1: Setting Up a Repository

```
sudo zypper addrepo https://download.opensuse.org/repositories/Emulators/openSUSE_Leap_42.3/Emulators.repo
sudo zypper refresh
```

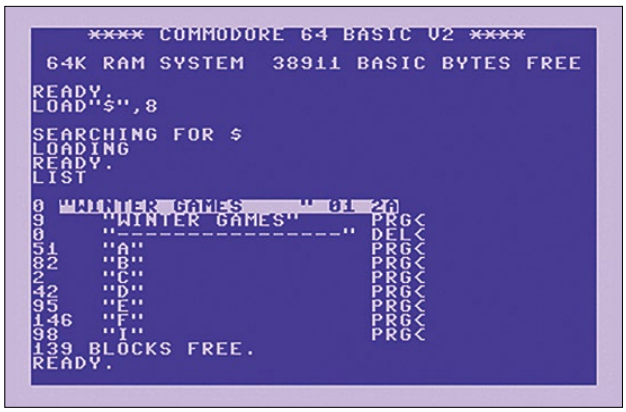


Figure 3: Emulators even bring home computers like the Commodore 64 back from the dead.

sites offer ROM file downloads – that is, ready-to-run images that the emulators can execute directly. However, you should not ignore the fact that, even many years after the release date of the software, downloading a ROM image file without a legal license for the game is a copyright infringement. That said, acquiring the latter is no obstacle. You can buy used associated hardware cartridges for many classics from the 1980s for a dollar on eBay.

Vibes

When you launch a game in an emulator, you may soon feel as if you've been transported back in time: Heroes like Super Mario and company are back on the screen, and memories of those hard-to-solve levels are revived. Yet, the gaming experience is different from back then: Playing on a PC keyboard gives you a different feeling than using a traditional console. Again, this is easy to remedy: Today, you can buy gamepads for about $10 that use the same design as the Nintendo NES [5] or SNES [6] originals. You just connect them to a standard USB port on your PC.

On the software side, the command

```
jstest --event /dev/input/js0
```

tests whether the hardware is detected correctly by the PC when you press any button on the gamepad. If *jstest* is output in the terminal window text, everything is okay. If not, you probably only need to select a different device. To do so, replace `js0` with `js1` or `js2`. In each emulator, you need to use the matching device.

Some people go even further to revive the original 1980s feel by connecting their old CRT TV languishing in the attic to the PC via an adapter cable. Others build wooden housings that resemble the old arcade game machines to accommodate their PCs. Not everyone, however, wants to go that far. You can bring back the fun of days gone by on a openSUSE PC by investing a little time, launching an emulator, and connecting a gamepad. ■

Info

[1] DOSBox: *https://www.dosbox.com*
[2] Classic games on gog.com: *http://www.gog.com/*
[3] ScummVM: *https://www.scummvm.org*
[4] Adventure classics available as freeware downloads: *http://scummvm.org/games*
[5] USB NES controller: *https://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Daps&field-keywords=controllers+nes+usb&rh=i%3Aaps%2Ck%3Acontrollers+nes+usb*
[6] USB SNES controller: *http://www.amazon.com/Retro-Nintendo-Controller-Not-Machine-Specific/dp/B0034ZOAO0/*

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