
Fedora 23

Release Notes

Release Notes for Fedora 23



Edited by The Fedora Docs Team

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Abstract

This document provides the release notes for Fedora 23. It describes major changes offered as compared to Fedora 22. For a detailed listing of all changes, refer to the Fedora Technical Notes.

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1. Welcome to Fedora 23

1.1. Welcome to Fedora

You can help the Fedora Project community continue to improve Fedora if you file bug reports and enhancement requests. Refer to [Bugs And Feature Requests](http://fedoraproject.org/wiki/BugsAndFeatureRequests)¹, on the Fedora wiki, for more information about bug and feature reporting. Thank you for your participation.

To find out more general information about Fedora, refer to the following pages, on the Fedora wiki (<http://fedoraproject.org/wiki/>):

- [Fedora Overview](http://fedoraproject.org/wiki/Overview)²
- [Fedora FAQ](http://fedoraproject.org/wiki/FAQ)³
- [Help and Discussions](http://fedoraproject.org/wiki/Communicate)⁴

¹ <http://fedoraproject.org/wiki/BugsAndFeatureRequests>

² <http://fedoraproject.org/wiki/Overview>

³ <http://fedoraproject.org/wiki/FAQ>

⁴ <http://fedoraproject.org/wiki/Communicate>

- [Participate in the Fedora Project](#)⁵

1.1.1. Need Help?

There are a number of places to get assistance if you encounter problems.

If you encounter a problem and would like some assistance, go to <http://ask.fedoraproject.org>. Previous questions and answers are there. If you cannot find your problem, simply post a new question. This helps other people who may have the same issue as you.

You may also find assistance on the **#fedora** channel on the IRC net **irc.freenode.net**. Please keep in mind that the channel is populated by volunteers wanting to help; people with specific knowledge and skills may not always be available.

1.2. Overview

As always, Fedora continues to develop (*Red Hat contributions*⁶) and integrate the latest free and open source software. The following sections provide a brief overview of major changes from the last release of Fedora.

For more details about the features that are included in Fedora 23 refer to the individual wiki pages that detail feature goals and progress: <https://fedoraproject.org/wiki/Releases/23/ChangeSet>. For a list of known issues in Fedora 23, see *Common F23 Bugs*⁷.

1.3. Hardware Overview

Fedora 23 provides software to suit a wide variety of applications. The storage, memory and processing requirements vary depending on usage. For example, a high traffic database server requires much more memory and storage than a business desktop, which in turn has higher requirements than a single-purpose virtual machine.

1.3.1. Minimum System Configuration

The figures below are a recommended minimum for the default installation. Your requirements may differ, and most applications will benefit from more than the minimum resources.

1GHz or faster processor
1GB System Memory
10GB unallocated drive space

Low memory installations

Fedora 23 can be installed and used on systems with limited resources for some applications. Text, vnc, or kickstart installations are advised over graphical installation for systems with very low memory. Larger package sets require more memory during installation, so users with less than 768MB of system memory may have better results performing a minimal install and adding to it afterward.

⁵ <http://fedoraproject.org/wiki/Join>

⁶ http://fedoraproject.org/wiki/Red_Hat_contributions

⁷ https://fedoraproject.org/wiki/Common_F_bugs

1.3.2. Display resolution

Graphical Installation requires 800x600 resolution or higher

Graphical installation of Fedora 23 requires a minimum screen resolution of 800x600. Owners of devices with lower resolution, such as some netbooks, should use text or VNC installation.

Once installed, Fedora will support these lower resolution devices. The minimum resolution requirement applies only to graphical installation.

1.3.3. Graphics Hardware

1.3.3.1. Minimum Hardware for Accelerated Desktops

Fedora 23 supports most display adapters. Modern, feature-rich desktop environments like GNOME3 and KDE Plasma Workspaces use video devices to provide 3D-accelerated desktops. Older graphics hardware may *not support* acceleration:

Intel prior to GMA9xx

NVIDIA prior to NV30 (GeForce FX5xxx series)

Radeon prior to R300 (Radeon 9500)

1.3.3.2. CPU Accelerated Graphics

Systems with older or no graphics acceleration devices can have accelerated desktop environments using LLVMpipe technology, which uses the CPU to render graphics. LLVMpipe requires a processor with SSE2 extensions. The extensions supported by your processor are listed in the `flags` section of `/proc/cpuinfo`

1.3.3.3. Choosing a Desktop Environment for your hardware

Fedora 23 Workstation's default desktop environment, GNOME3, functions best with hardware acceleration. Alternative desktops, such as those featured in [Section 2.4, "Fedora Spins"](#), are recommended for users with older graphics hardware or those seeing insufficient performance with LLVMpipe.

Desktop environments can also be added to an existing installation and selected at login. To list the available desktops, use the `dnf grouplist` command:

```
dnf group list -v hidden | grep desktop
```

Install the desired group:

```
dnf group install "KDE Plasma Workspaces"
```

Or, use the short group name to install:

```
dnf install @mate-desktop-environment
```

1.4. Feedback

Thank you for taking the time to provide your comments, suggestions, and bug reports to the Fedora community; this helps improve the state of Fedora, Linux, and free software worldwide.

To provide feedback on Fedora software or other system elements, please refer to [Bugs And Feature Requests](#)⁸. A list of commonly reported bugs and known issues for this release is available from [Common Fedora 23 bugs](#)⁹

To provide feedback on the Release Notes, use <http://bugzilla.redhat.com/>¹⁰.

2. Fedora Editions

For more than ten years, the Fedora Project has provided a distribution at the leading edge of the open source ecosystem. Fedora's releases have offered the latest technologies, integrating new and exciting upstream developments into a vast and diverse set of packages.

Users have built powerful desktops, reliable servers, and more recently, versatile cloud instances from the high quality packages in the Fedora repository. Fedora's strong commitment to upstream integrity gives developers a place to showcase their work, and benefit from Fedora's active testing and development volunteers.

In those ten years, much has changed. The **Fedora . next** initiative represents a considered strategy for maintaining the quality of the distribution and Fedora's position in introducing new technologies, while also providing a more consistent target for developers.

The result of this initiative is three distinct Fedora flagship flavors. Fedora Cloud for scalable infrastructure, Fedora Server for organizational infrastructure, and Fedora Workstation for the developer and desktop user.

Fedora Spins, such as live media featuring alternative desktop environments, will continue to be produced.

Fedora also offers images and support for an ever-increasing number of ARM devices, both large and small.

2.1. Fedora Cloud

Fedora Cloud is the base building block of the Fedora flavors, ready to be deployed on the fly to meet your changing needs. These small images are backed by the vast set of applications and utilities available in the Fedora package repositories.

Cloud images are available in several varieties:

2.1.1. Cloud Base

Just the basics, this image is ready to be customized for your needs.

2.1.2. Atomic

Cutting edge [Project Atomic](#)¹¹ tools make this image the ideal host for containers. Instead of upgrades to individual packages, Atomic upgrades using **rpm-ostree** technology allow administrators to upgrade and roll back the entire core system as a single operation.

⁸ <http://fedoraproject.org/wiki/BugsAndFeatureRequests>

⁹ http://fedoraproject.org/wiki/Common_F23_bugs

¹⁰ [https://bugzilla.redhat.com/enter_bug.cgi?product=Fedora Documentation&component=release-notes](https://bugzilla.redhat.com/enter_bug.cgi?product=Fedora+Documentation&component=release-notes)

¹¹ <http://www.projectatomic.io/>

By combining Docker for versatile container deployments with SELinux to secure them, Fedora Atomic is an ideal solution for secure, modular deployments.

2.1.3. Converting Cloud instances to Fedora Server

Fedora Cloud excels for meeting organizational needs at scale with largely undifferentiated compute resources, but in some cases, an administrator might want to *adopt their cattle*¹² by converting a cloud instance to an individually managed Fedora Server installation.

To convert Fedora Cloud to Fedora Server, use the script provided in the *cloudtoserver* package.

2.1.4. Atomic Upgrade and Rollback via RPM-OSTree

Fedora 23 includes **RPM-OSTree**, a mechanism used on Fedora Atomic installations to perform atomic upgrades and rollbacks for the entire system (kernel as well as userspace).

Instead of performing a package-by-package installation and upgrade on each client machine, the tooling supports composing "sets of packages on a server side. Clients can then perform atomic upgrades as a tree.

On systems using **RPM-OSTree**, standard package managers (**DNF** and **Yum**) do not work normally; they can only be used in read-only mode.

For additional information about this tool and Fedora Atomic, see the *Fedora Project Wiki*¹³.

2.2. Fedora Server

2.2.1. Fedora Server Roles

A Featured Server role is an installable component of Fedora Server that provides a well-integrated service on top of the Fedora Server platform. These prepared roles simplify deployment and management of a service compared to setting up an upstream server from scratch; their use is recommended but optional; existing users of upstream servers based on Fedora RPMs will not be impeded.

Installation

For kickstart installations, you can use the *Fedora Server* environment group to deploy Server.

To initiate role deployment via kickstart, use the new **--deferred** argument to **rolectl**. Adding this argument will configure the system to deploy the specified role on the next boot.

2.2.1.1. Domain Controller Server Role

Fedora Server can deploy a domain controller powered by FreeIPA. The role greatly simplifies configuration of a primary domain controller.

When combined with SSSD, complex tasks such as single-sign-on and authenticated access to network resources is easily accomplished.

¹² <http://www.slideshare.net/randybias/architectures-for-open-and-scalable-clouds/20>

¹³ <https://fedoraproject.org/wiki/Changes/RpmOstree>

2.2.2. Database Server Role

Rapidly deploy instances of the powerful **postgresql** database server using the new Database Server Role for rolekit.

2.2.3. Cockpit Management Console

The **Cockpit Management Console** (the *Cockpit* package) is available by default in Fedora Server. This tool provides a powerful, easy to use, web-based graphical interface for managing multiple Linux servers. Features include:

- `systemd` service management
- Journal log viewer
- Storage configuration including LVM
- **Docker** container management
- Basic network configuration
- Adding and removing local users

Any user known to the server can log in to the **Cockpit** console by opening `http://server-ip-address:9090`.

New features for **Cockpit** in Fedora 23 include:

- *Secondary Server Authentication via SSH keys*

A single Cockpit instance can be used to manage many devices by connecting to them over ssh. Cockpit can now manage SSH keys to implement this securely. Read more at <http://files.Cockpit-project.org/guide/latest/authentication.html>

- *Manage User SSH keys*

Cockpit's user management interface can also manage a user's authorized keys.

- *Kubernetes dashboard*

Cockpit has grown a basic dashboard for managing container deployments with **Kubernetes**.

- *Time Zone management*

You now can use Cockpit to adjust the system time zone.

2.3. Fedora Workstation

Fedora Workstation is a reliable, user-friendly, and powerful operating system for laptops or desktop computers. It supports a wide range of developers, from hobbyists and students to professionals in corporate environments. The workstation edition comes with the Gnome desktop environment which supports a variety of current devices along with a wide array of software that aids quick and easy development.

For kickstart installations, you can use the *Fedora Workstation* environment group to deploy Workstation.

2.3.1. Updates to GNOME

Fedora 23 will include the latest version of the GNOME desktop environment: 3.18. See [Section 4.1.1, “GNOME”](#) for details.

Fedora Workstation contains the *fedora-user-agent-chrome* package by default. This package is used to provide a Fedora-specific user agent string to users who later download Google Chrome for web browsing. This brings the Google Chrome user agent string into closer alignment with the one used by default in the *firefox* package.

2.4. Fedora Spins

The Fedora Project also produces a number of **Spins** that provide alternative desktop environments, or package sets crafted for specific use cases. **Spins** are live images that you can use to preview a variety of software that Fedora has to offer.

Spins available for download from <https://spins.fedoraproject.org> have included:

- *KDE*

A complete, modern desktop built using the KDE Plasma Desktop.

- *Cinnamon*

A desktop environment based on the Gtk+ 3 toolkit.

This spin has been added in Fedora 23; see [Section 4.1.2, “Cinnamon Spin”](#) for details.

- *Security*

Security analysis tools.

- *Electronic-Lab*

Fedora's high-end hardware design and simulation platform.

- *Scientific-KDE*

Open Source Scientific Computing.

- *Design-suite*

Open Creativity.

- *Games*

A perfect show-case of the best games available in Fedora.

- *Robotics*

Dive into Robotics.

- *Jam-KDE*

Unleash your inner musician.

3. Changes in Fedora for System Administrators

3.1. Kernel

Fedora 23 features the 4.2.0 kernel.

3.2. Installation

3.2.1. General Anaconda Changes

- The **Anaconda** installer has been completely ported to Python 3 in Fedora 23. This will have no noticeable impact on your experience while installing Fedora, but is important to Anaconda's backend and to developers - especially those who create installer add-ons.

Python 3 is the next generation of the Python programming language. It is currently mature and stable, since it has been under active development for more than six years - version 3.0 was released in December 2008. Version 2.7 will continue being supported by upstream until 2020; however, this support concerns only necessary maintenance, not new features.

With the move to Python 3, Anaconda (and other packages which have also been ported) can use new features provided by Python upstream. By staying close to upstream, Fedora can also better help the Python community go forward by contributing patches.

3.2.2. Changes in Anaconda's Text Interface

- Handling of non-Latin scripts in text mode has been improved. It uses an appropriate font if possible, and falls back to English if the language cannot be displayed by the Linux console.
- Rescue mode has been reworked to use the same interface as the text mode installer instead of ncurses.

3.2.3. Changes in Kickstart Syntax

- Software environment handling should now be more robust.
- New command: **reqpart**. This command creates any partitions which are required by your hardware platform. For example, IBM Power Systems servers require a small PREP Boot partition, 64-bit Intel-compatible systems with BIOS firmware and GUID Partition Table (GPT) on the boot drive require a biosboot partition, etc.

The **reqpart** command can not be used together with **autopart**. Unlike **autopart**, it can be used together with additional partitioning commands; you can use **reqpart** to create whatever partitions are necessary, and then use other storage configuration commands such as **part** to create the rest of the partitioning layout.

This command has one option: **--add-boot**. This option will also create a separate **/boot** partition in addition to platform-specific partitions created by the base command.

- The **reboot** command has a new option: **--kexec**. Use this option to reboot into the new system using the kexec kernel switching mechanism instead of a full reboot, bypassing the BIOS/Firmware and boot loader.
- The **logvol** command has new options which are all used to create cached logical volumes:

- `---cachesize=` - Requested size (in MiB) of cache attached to the logical volume. (Requires `--cachepvs`).
- `--cachepvs=` - A comma-separated list of (fast) physical volumes that should be used for the cache.
- `--cachemode=` - The mode which should be used for the cache - either **writeback** or **writethrough**.

See the `lvmcache(7)` man page for more information about LVM caching.

- The **btrfs**, **logvol**, **part** and **raid** commands all have a new option: `--mkfsoptions=`. This option specifies additional parameters to be passed to the program (mkfs) that makes a file system on this partition, volume or subvolume. No processing is done on the list of arguments, so they must be supplied in a format that can be passed directly to mkfs. This means multiple options should be comma-separated or surrounded by double quotes, depending on the file system.

3.2.4. System Upgrades with DNF

Upgrade to Fedora 23 with the native package manager **dnf**. The updates are performed in an *offline* environment that allows system packages to be safely replaced.

Procedure 1. Upgrading with DNF

1. This upgrade functionality comes from a dnf plugin. Install the package:

```
# dnf install dnf-plugin-system-upgrade
```

2. Update your system.

```
# dnf update
```

3. Some third party repos may not be available for the next version of Fedora. Check the status of your configured repositories:

```
#dnf repolist --releasever 23
```

If problems are reported with a repository, you may wish to disable it:

```
# dnf config-manager --set-disabled repo-name
```

4. Prepare the upgrade environment.

```
#dnf system-upgrade download --releasever 23
```

5. Reboot to perform the upgrade.

```
# dnf system-upgrade reboot
```

6. If an upgrade fails, clean up the download, resolve any issues, and try again.

```
# dnf system-upgrade clean
```

Syncing package versions

By default, if a package is a newer version than the same package in the target Fedora release, it will not be replaced. Some common post-installation issues involving packages from mixed repositories can be resolved by performing a **distribution synchronization**, or **distro-sync**, which ensures that packages are replaced with those in the target repos, wherever possible.

You can perform this operation during the system upgrade with the **--distro-sync**.

3.3. Boot

The dracut utility, which is used to create the initramfs image used during the boot process, can now create a UEFI-bootable executable. The **--uefi** argument allows dracut to create a single UEFI executable, including an EFI stub, kernel, and initramfs.

3.4. Security

3.4.1. Disable SSL 3.0 and RC4

The SSL 3.0 protocol and the RC4 cipher are considered insecure and vulnerable to attacks. As such, both are now disabled by default for all Fedora components which use system-wide crypto policies. This includes the `gnutls` and `openssl` libraries and all applications based on them.

Applications or environments that require SSL 3.0 or RC4 can use [update-crypto-policies](#)¹⁴ to globally switch to the **LEGACY** policy to enable them.

Note

Applications that use TLS from NSS are not affected by this change.

3.4.2. OpenSSH 7.1

The OpenSSH project continues to improve the security of network communication with the release of **OpenSSH 7.1**. See the [upstream release notes](#)¹⁵ for detailed information about this release.

¹⁴ <https://github.com/nmav/fedora-crypto-policies/blob/master/update-crypto-policies.8.txt>

¹⁵ <http://www.openssh.com/txt/release-7.1>

3.4.3. Package Hardening

Packages built for Fedora 23 will be compiled with a position-independent code flag (**ASLR**) and **FULL RELRO** enabled by default. This was previously an optional setting; requiring it by default will protect users from certain potential security vulnerabilities.

Find more information about this change at http://fedoraproject.org/wiki/Changes/Harden_All_Packages.

3.4.4. Standardized Passphrase Policy

A common password policy is being utilized in Fedora 23 to provide a set of consistent rules for password policies. These rules can be modified locally to fit user needs. Information about the default policy is available at https://fedoraproject.org/wiki/Passphrase_policy.

4. Changes in Fedora for Desktop Users

4.1. Desktop

4.1.1. GNOME

Fedora 23 features the latest available version of the **GNOME** desktop environment - 3.18 (codename Gothenburg). This release brings several major new features as well as many smaller improvements and bug fixes. The code name was chosen in recognition of the volunteer team which organized the 2015 GUADEC conference in Gothenburg, Sweden.

Major new features of GNOME 3.18 include:

Google Drive integration

You can now access your Google Drive directly from the **Files** application as well as from file chooser dialogs. To use this feature, add your Google account through your **Online Account** settings.

Files improvements

- A new location called **Other Locations** has been added to the files places side bar, which is shown in the **Files** browser and in open and save dialogs. This location provides an overview of some local and network locations. Many of those locations are no longer shown in the side bar, which helps avoid clutter.
- Long-running operations such as copying or moving a large number of files have been improved. **Files** now features a button in the header bar, showing file transfer progress when pressed. This allows you to easily see the progress of all running file transfers at once, and avoids cluttering your screen with multiple file transfer dialog windows.
- A new search feature has been added to file open and save dialogs.
- Context menus can now be activated on a touch screen using press and hold.
- Placeholders are now displayed when folders are empty, or when no search results are found.
- Recent file lists now show the full path to each displayed file.
- Recursive search is now disabled on remote locations (network storage) to prevent performance problems.

- Improved dynamic backlight support for devices with brightness sensors.

Firmware updates

GNOME 3.18 fully integrates [Linux Vendor Firmware Service](#)¹⁶, an initiative to provide a streamlined, automated process for installing device firmware. This service is integrated into the **Software** application, and firmware updates can be installed the same way you can install package updates.

Automatic screen brightness

On computers with integrated light sensors, GNOME can now automatically adjust screen brightness. This helps increase user comfort as well as save battery power on laptops. Automatic brightness adjustment can be disabled in **Power** settings.

New Calendar application

A new application, **Calendar**, is now integrated into GNOME, providing a calendar application fully consistent with other GNOME applications, including integration with **Online Account**.

New Characters application

Characters is another new application in GNOME 3.18. It provides an easy way to find and use a variety of characters in documents and communications, such as punctuation marks, currency and mathematical symbols. Characters are sorted into categories for easy searching, and the application can also remember your recently used symbols and provides them in the **Recently Used** tab for easy repeated access.

GNOME is installed by default on Fedora Workstation, and is also available with other variants of Fedora 23. If your system does not have GNOME installed, use **dnf group install gnome-desktop** as root to add it to your system. After the installation finishes, log out of your current session and choose GNOME as your desktop environment when logging back in.

For additional information about **GNOME 3.18**, as well as screenshots of new features described above, see the upstream [GNOME 3.18 Release Notes](#)¹⁷ and [Other Improvements in GNOME 3.18](#)¹⁸ for information about other changes.

A list of languages available for GNOME is available at [Internationalization](#)¹⁹. Information for developers and system administrators is available at [What's New for Developers and System Administrators](#)²⁰.

4.1.2. Cinnamon Spin

The Cinnamon desktop version 2.6 is now available as a Spin for Fedora 23. Cinnamon is a modern desktop environment based on the GNOME Shell, with advanced features and a traditional and flexible user experience.

Updates and improvements in this release include:

- Improved multi-monitor support
- HTML5 and XScreenSaver support for animated screensavers
- Panel management improvements

¹⁶ <http://www.fwupd.org/>

¹⁷ <https://help.gnome.org/misc/release-notes/3.18/index.html.en>

¹⁸ <https://help.gnome.org/misc/release-notes/3.18/more.html.en>

¹⁹ <https://help.gnome.org/misc/release-notes/3.18/i18n.html.en>

²⁰ <https://help.gnome.org/misc/release-notes/3.18/developers.html.en>

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- New inhibit applet to hide notifications and temporarily suspend power saving events
- Redesigned system settings panel for improved usability
- Accessibility improvements, including better support for ATK/Orca, magnifiers, and a new On-Screen Keyboard applet

See the [Cinnamon official website](http://cinnamon.linuxmint.com/)²¹ for more information on Cinnamon, and go to <http://spins.fedoraproject.org> to download the Spin.

4.1.3. Sugar

Originally started as part of the One Laptop per child initiative, Sugar is a desktop environment targeted for children ages 5 - 12 to provide learning and educational activities through rich media. Sugar is the core component of a worldwide effort to provide every child with the opportunity for a quality education.

This update to sugar 0.106 includes the following:

- improved performance
- updated activities
- New social help for access to discussion forums and collaborative learning

See the [SugarLabs release notes](#)²² for more information on this sugar release.

4.2. Productivity

4.2.1. Firefox 40

Fedora 23 provides the latest version of **Mozilla Firefox**, the world-favorite web browser. The powerful and extensible browser is kept up to date to keep your web surfing secure and smooth. For detailed information about the 40 release, see [Firefox Notes](#)²³.

4.2.2. Thunderbird 38

The **Thunderbird** e-mail client now includes the **Lightning** calendar and scheduling extension by default. Use it for todo lists, e-mailed invitations, and more. For full details on changes in **Thunderbird**, see the project's [Release Notes](#)²⁴.

4.2.3. LibreOffice 5

Fedora 23 provides LibreOffice version 5, the latest mayor release of the default office suite. Some of the features of this release are:

- Now it is possible to crop an image with the mouse.
- Data bars in rows with conditional formatting in **Calc**.

²¹ <http://cinnamon.linuxmint.com/>

²² <http://wiki.sugarlabs.org/go/0.106/Notes>

²³ <https://www.mozilla.org/en-US/firefox/40.0/releasesnotes/>

²⁴ <https://www.mozilla.org/en-US/thunderbird/38.0.1/releasesnotes/>

- Improvements in handling .doc, .rtf, .xlsx and xml formats.

See the [Release Notes](#)²⁵ for a comprehensive list of all new features in this release.

4.3. Networking

4.3.1. NetworkManager

Fedora 23 includes **NetworkManager** version 1.0.6, an upgrade from version 1.0.2 provided in Fedora 22. Some of the notable changes in this version are:

- The command line network configuration utility **nmcli** has gained tab autocompletion and hints for more properties.
- Device management can now be controlled with udev rules.
- Interfaces such as veth and those from various virtualization tools like **VMWare**, **VirtualBox**, and **Parallels** are now ignored by default.
- Numerous bug fixes and behavior enhancements.

See the [NetworkManager 1.0.6 release announcement](#)²⁶ and [NetworkManager 1.0.4 release announcements](#)²⁷ for a summary of changes between versions 1.0.2 and 1.0.6.

4.4. Internationalization

4.4.1. Input Methods

- `ibus-libzhuyin` ("New Zhuyin") is now the default Traditional Chinese Zhuyin input method.
- IBus now supports the format of X11 compose file and loads `$HOME/.XCompose`.
- IBus panel now shows XKB language prefix on the icon per XKB layout instead of `ibus-keyboard.svg` on the **KDE Plasma 5** desktop environment.

4.4.2. Fonts

- Lohit Devanagari, Lohit Telugu and Lohit Bengali have been updated with Unicode 8.0 support.

5. Changes in Fedora for Developers

5.1. Development

5.1.1. Perl 5.22

The version of Perl in Fedora 23 is now 5.22

²⁵ <https://wiki.documentfoundation.org/ReleaseNotes/5.0>

²⁶ <https://mail.gnome.org/archives/release-team/2015-August/msg00041.html>

²⁷ <https://mail.gnome.org/archives/ftp-release-list/2015-July/msg00025.html>

Release Notes

New Features:

- Bitwise operators allows to perform bit-based operation on strings.
- Double-diamond operator allows to process script arguments as file names safely.
- Regular expression operators `\b{}` and `\B{}` allow to match character boundaries according to Unicode rules.
- Stricter regular syntax rules can be enabled with `use re 'strict'`.
- Unicode 7.0 is supported.
- Variables and subroutines can now be aliased by assigning to a reference.
- `fileno()` function works on directory handles now.
- Special floating point values infinity and non-a-number are more robustly propagated in computations.
- Hexadecimal floating point literals are supported and `printf "%a"` can print them.
- Class and method name look-up for identifiers known and compile-time is faster now.
- Computing length of byte-strings is faster.
- Hash look-ups where the key is a constant are faster.
- New `perlunicook` manual with examples of handling Unicode in Perl.
- `sync_locale()` XS function allows to notify interpreter that the locale had changed.

Changes:

- Packing infinity and not-a-number values into a character results into a fatal error.
- `ampersand` and `backslash ampersand` prototype symbols accepts only anonymous subroutines.
- Deprecated encoding pragma is now limited to lexical scope.
- List slices return an empty list only if the original list was empty.
- `\N{}` with a sequence of multiple spaces results into a fatal error.
- Importing functions from `UNIVERSAL` module results into a fatal error.
- Splitting `(?` and `(*` tokens in regular expressions results into a fatal error.
- Omitting `%` and `@` symbols before hash and array identifiers is not allowed anymore.
- `#!` error string out of use locale scope is in English now.
- `#!` error string is marked as UTF-8-encoded when appropriate.
- Using `m?PATTERN?` expression without leading `m` results into error now.
- Using `defined()` operator on an array or a hash results into fatal error now.
- Using a hash or an array as an reference results into fatal error now.
- Setting `${^ENCODING}` to an defined value is deprecated. Scripts should be written in UTF-8 now.

- Multiple use of /x regular expression modifier is deprecated.
- Literal left curly bracket should be escaped in regular expressions.
- B module has new classes reflecting changes in perl internals.
- Accessing CvPADLIST in on an XSUB is forbidden.
- Internal representation of SVt_NV type has changed.
- PADNAME and PADNAMELIST types are no longer aliases to SV and AV.

Removed features:

- CGI and Module::Build modules have been removed from core perl distribution.
- find2perl, s2p, and a2p' tools have been removed from core perl distribution.
- Perl_tmpr_grow() XS function has been removed.
- SETsv and SETsvUN() macros have been removed.

For More Information please visit:

- ["Fedora 23 Perl 5.22 Change Page"](#)²⁸
- [cpan.org perl-5.22 perl delta page](#)²⁹

5.1.2. Fedora is moving to Python 3

Fedora 23 continues the move to Python 3 as the default python interpreter. Critical system components built using python, such as the **Anaconda** installer, the **dnf** package manager, and more have been migrated to the newer Python release.

Packaged Python modules and utilities are available in Python 3 versions wherever upstream supports it.

Python 2.7 (latest Python 2 release, which we also have in Fedora) is currently in maintenance mode only, which means upstream only accepts bugfixes and security fixes, but no new features are being implemented. Python 2.7 is the last minor release of Python 2, with upstream support until 2020. Python 3, on the other hand, is actively developed and new features are being added every release. Moreover, there is currently no end of support date for Python 3.

For more details of Fedora's Python migration plan, please visit: [Python 3 default change in Fedora 23](#)³⁰

²⁸ <https://fedoraproject.org/wiki/Changes/perl5.22>

²⁹ <http://search.cpan.org/dist/perl-5.22.0/pod/perldelta.pod>

³⁰ https://fedoraproject.org/wiki/Changes/Python_3_as_Default#Scope



`/usr/bin/python`

The **python** executable will not be installed by default on many Fedora 23 systems. The Python project, in [PEP 0394](#)³¹, recommends that `/usr/bin/python` remain associated with Python 2, which may not be installed.

Users with scripts or similar that require `/usr/bin/python` can install it, or use the new `/usr/bin/python3` interpreter.

5.1.3. Mono upgrade to 4.0

Support for Mono versions 3.0 and 2.10 has been discontinued. No further development of bug fixing is planned for those branches. Mono 4 is the active branch and has many improvements.

For details on the current Mono release, [See Upstream notes](#)³²

5.2. Development Tools

5.2.1. Eclipse

Eclipse in Fedora has had a major update to the Mars (4.5) release. Some new key features in this release include:

Brand new docker for managing docker containers and images.

Support for the **git flow** branching model within the IDE.

A new **Launch Bar** for C/C++ projects that highly simplifies launching your projects either on the local machine or on a remote device.

Full details of the release are available in the upstream projects' release notes, which are available from the following locations:

Eclipse Platform and Java Tooling: <https://www.eclipse.org/eclipse/news/4.5/>

Eclipse C/C++ Development Tools: <https://wiki.eclipse.org/CDT/User/NewIn87>

Eclipse Linux Tools: https://wiki.eclipse.org/Linux_Tools_Project/News/NewIn40

Eclipse Git Support: https://wiki.eclipse.org/EGit/New_and_Noteworthy/4.0

5.3. GCC Tools

5.3.1. boost 1.59.0

Fedora 23 includes **Boost 1.59.0**. For information on changes in recent Boost releases, please visit:

http://www.boost.org/users/history/version_1_58_0.html

http://www.boost.org/users/history/version_1_57_0.html

http://www.boost.org/users/history/version_1_56_0.html

³¹ <https://www.python.org/dev/peps/pep-0394/>

³² <http://www.mono-project.com/docs/about-mono/releases/4.0.0/>

A. Contributors

A large number of people contribute to Fedora each release. Among these are a number of writers and translators who have prepared these release notes. The following pages list those contributors.

A.1. Writers

Fedora Documentation Project

- The Fedora Docs team

B. Revision History

Revision **Wednesday, November 18** **Fedora> Docs**
23-05 **2015** [docs AT lists.fedoraproject.org](mailto:docs@lists.fedoraproject.org)
 Fixed spelling error in Development_Tools bug # 1283087

Revision **Wednesday, November 4 2015** **Fedora> Docs**
23-04 [docs AT lists.fedoraproject.org](mailto:docs@lists.fedoraproject.org)
 Fixed Entry in Article.xml that did not reference Release_Notes.ent

Revision **Monday, November 2 2015** **Fedora> Docs**
23-03 [docs AT lists.fedoraproject.org](mailto:docs@lists.fedoraproject.org)
 Fedora 23 0-Day

Revision **Monday, October 12 2015** **Fedora Docs**
23-02 [docs AT lists.fedoraproject.org](mailto:docs@lists.fedoraproject.org)
 Fedora 23 Final Freeze

Revision **Tuesday, September 22 2015** **Fedora Docs**
23-01 [docs AT lists.fedoraproject.org](mailto:docs@lists.fedoraproject.org)
 Fedora 23 Beta Release

Revision **Monday, Aug 31 2015** **Fedora Docs**
23-00 [docs AT lists.fedoraproject.org](mailto:docs@lists.fedoraproject.org)
 Perl 5.22 update

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