Openwrt docs Documentation

Release

People on the internet

Nov 12, 2017

Contents

The LEDE Project ("Linux Embedded Development Environment") is a Linux operating system based on OpenWrt. It is a complete replacement for the vendor-supplied firmware of a wide range of wireless routers and non-network devices. See the Table of Hardware for supported devices. For more information about LEDE Project organization, see the *About LEDE* page.

Why use LEDE?

People install LEDE because they believe it works better than the stock firmware from their vendor. They find it is more stable, offers more features, is more secure and has better support.

- **Extensibility:** LEDE provides many capabilities found only in high-end devices. Its 3000+ application packages are standardized, so you can easily replicate the same setup on any supported device, including two (or even five) year old routers. More about extensibility...

- **Security:** LEDE's standard installation is secure by default, with Wi-Fi disabled, no poor passwords or backdoors. LEDE's software components are kept up-to-date, so vulnerabilities get closed shortly after they are discovered. More about security...

- **Performance and Stability:** LEDE firmware is made of standardized modules used in all supported devices. This means each module will likely receive more testing and bug fixing than stock firmware which can be tweaked for each product line and never touched again. More about performance and stability...

- **Strong Community Support:** LEDE team members are regular participants on the LEDE Forum, LEDE Developer and LEDE Admin mailing lists, and LEDE's IRC channels. You can interact directly with developers, volunteers managing the software modules and with other long-time LEDE users, drastically increasing the chances you will solve the issue at hand. More about community...

- **Research:** Many teams use LEDE as a platform for their research into network performance. This means that the improvements of their successful experiments will be available in LEDE first, well before it gets incorporated into mainline, vendor firmware. More about research...

- **Open Source/No additional cost:** LEDE is provided without any monetary cost. It has been entirely created by a team of volunteers: developers and maintainers, individuals and companies. If you enjoy using LEDE, consider contributing some effort to *help us improve it for others!* All of the above is possible because LEDE is part of the Open Source community, and powered by Linux kernel. Get the source code...

- **And more...** See more Reasons to Use LEDE...

Download LEDE

LEDE wants you!

Like any open source project, LEDE thrives on the efforts of its users and developers.

- If you want to develop the software, please refer to our Developer Guide to learn how to get the source code, build it, and contribute your changes back to the project.

- If you're not a developer, you can still help. The documentation can always be improved (even if it's to verify that the instructions match your experience), or you can help other community members with questions. Don't hesitate to Register yourself in the wiki, or join our mailing list and IRC channels to get in touch.

Contents

Lede documentation is organised in a set of guides, a table of supported hardware, and package reference.

4.1 LEDE Project Information

In the following sections you will be able to find all the resources contained . In the following list you can find information about the project.

4.1.1 Reasons to Use LEDE

People install LEDE because they find it to be superior to the stock firmware of their router or embedded device. This page showcases many aspects of LEDE.

Performance & Stability

LEDE is designed by network professionals and others who care about the performance of their network. LEDE incorporates n

- LEDE is stable, and operates reliably for long periods of time.
- LEDE reduces latency/lag and increased network throughput via bufferbloat control algorithms.
- Wi-Fi improvements support higher data rates and airtime fairness between stations.
- Older devices are still supported by LEDE improvements (as long as RAM/Flash of your device can accommodate new releases) long after the manufacturer stops making updates.

Security

LEDE is an open source software. Many developers from all over the world review the code before it's released.

- No hidden backdoors left by hardware vendors.

- LEDE is resistant to common vulnerabilities thanks to its Linux OS which is unaffected by many common attacks.

- LEDE is actively updated so any vulnerabilities are closed shortly after they are discovered.

- Default LEDE configuration is very conservative allowing full internet connectivity without exposing your router or connected devices to attacks.

- Many of the older devices are supported by LEDE and can enjoy security LEDE brings, long after vendors stop releasing firmware updates.

- LEDE prolongs the life of your router. While many vendors only provide updates for your router/device until the newer model is released, LEDE supports all compatible models for as long as their RAM/Flash can accommodate new releases.

Extensibility

While vendor firmware for a router ships with a fixed set of capabilities, LEDE provides more than 3000 packages ready to be i

- Run ad blocking on your router so you can enjoy clean uncluttered web experience from any connected device.

- Reduce latency/lag (bufferbloat) even during heavy traffic with Smart Queue Management

- Secure access to your home network when away via OpenVPN Server.

- Secure your internet access and prevent your ISP from snooping on your internet activity (requires third party service) OpenVPN Client.

- Prevent your ISP from snooping on your DNS requests via DNSCrypt Proxy.

- Force connected devices with hard-coded DNS servers to use your router's DNS with DNS Request Hijacking.

- Create a Guest Network for Guest WiFi allowing access to internet, but not your local devices.

- Control access using the time limits and parental controls.

- Add a webcam for live surveillance or timelapse video creation of landscapes or 3D printers.

- Connect to your weather station, record weather statistics and make them accessible via a webserver, garnished with a live webcam image.

- Interact with 1-wire devices (sensors, actors, ...).

- Make your router a central for home automation.

- Access a wider range of Dynamic DNS (ddns) providers than vendor firmware via DDNS scripts.

Community Support

The vibrant community of developers, volunteers, and other long-time LEDE users are always available to help solve an issue.

- LEDE forum - member-to-member conversations about LEDE

- LEDE Developer and LEDE Admin mailing lists

- #lede-dev and #lede-adm on Freenode IRC

- Refer to the *contact page* for a complete list to contact the project.

Research Platform

Many teams who are doing cutting-edge research into networking topics use LEDE as a stable platform for their work. As their

- Continuing development of the fq_codel and cake algorithms that decrease bufferbloat.
- The Make Wi-Fi Fast team has been working to decrease queueing and latency in the wi-fi stack, and is testing out their airtime fairness code using LEDE.
- Homenet provides implementation of zeroconf IPv6 (and IPv4) routing, prefix assignment and service discovery for a home network consisting of multiple routers connected to multiple service providers. There's a hnet-full package for LEDE.

Configuration

Because LEDE is a true Linux-based system, you have full control over all functions of your router/device.

- LEDE provides both command-line interface (via SSH) and a web-based user interface for configuration.
- Configuration information is stored in plain-text files to ease the editing and/or copying.
- LEDE Image Builder allows you to create your own firmware images for your device with any customizations (pre-defined password, WiFi, etc).
- The Web GUI allows you to select themes that suit your needs/tastes In addition, Localization of Web UI is available via packages in over 20 languages.
- Configure the external LEDs and buttons/switches to suit your needs.

Zero Cost

LEDE is provided for free through its GPL license, and thanks to the efforts of many volunteer contributors (both individuals and companies). There are no subscription or licensing fees.

4.1.2 About the LEDE project

A reboot of the OpenWrt community

The LEDE project is founded as a spin-off of the OpenWrt project and shares many of the same goals. We are building an embedded Linux distribution that makes it easy for developers, system administrators or other Linux enthusiasts to build and customize software for embedded devices, especially wireless routers. The name **LEDE** stands for **L**inux **E**mbedded **D**evelopment **E**nvironment.

Members of the project already include a significant share of the most active members of the OpenWrt community. We intend to bring new life to Embedded Linux development by creating a community with a strong focus on transparency, collaboration and decentralisation.

LEDE's stated goals are:

- Build a great embedded Linux distribution with focus on stability and functionality.
- Make regular, predictable release cycles coupled with community provided device testing feedback.
- Establish transparent decision processes with broad community participation and public meetings.

We decided to create this new project because of long standing issues that we were unable to fix from within the OpenWrt project/community:

- Number of active core developers at an all time low, no process for getting more new people involved.

- Unreliable infrastructure, fixes prevented by internal disagreements and single points of failure.

- Lack of communication, transparency and coordination in the OpenWrt project, both inside the core team and between the core team and the rest of the community.

- Not enough people with commit access to handle the incoming flow of patches, too little attention to testing and regular builds.

- Lack of focus on stability and documentation.

To address these issues we set up the LEDE project in a different way compared to OpenWrt:

- All our communication channels are public, some read-only to non-members to maintain a good signal-to-noise ratio.

- Our decision making process is more open, with an approximate 50/50 mix of developers and power users with voting rights.

- Our infrastructure is simplified a lot, to ensure that it creates less maintenance work for us.

- We have made our merge policy more liberal, based on our experience with the OpenWrt package github feed.

- We have a strong focus on automated testing combined with a simplified release process.

Name

The name **LEDE** is an abbreviation for **L**inux **E**mbedded **D**evelopment **E**nvironment, a reference to its flexibility and embedded buildroot origins, making it a solid choice for embedded Linux applications far beyond the wireless router and network appliance realm.

Project Meetings

We attempt to have regular IRC meetings to discuss and decide project matters.

Next Meeting

The next meeting date is yet to be decided.

For the agenda of the upcoming meeting refer to the agenda pad.

Meeting Logs

All meeting logs can be viewed here.

People

Here you can find an alphabetically ordered list of the current people involved in the development of the **LEDE** Project:

Developers	Nickname
Alexander Couzens	lynxis
Álvaro Fernández Rojas	noltari
Daniel Golle	dangole
Felix Fietkau	nbd
Florian Fainelli	[florian]
Hans Dedecker	dedeckeh
Hauke Mehrtens	hauke
Imre Kaloz	kaloz
Jo-Philipp Wich	jow
John Crispin	blogic
Jonas Gorski	jogo
Luka Perkov	luka
Mathias Kresin	mkresin
Matthias Schiffer	neoraider
Mirko Vogt	mirko
Piotr Dymacz	pepe2k
Rafał Miłecki	rmilecki
Steven Barth	cyrus
Stijn Tintel	stintel
Ted Hess	thess
Yousong Zhou	yousong
Zoltan Herpai	wigyori

And in charge of the documentation:

Wiki Documentation	Nickname
Thomas Endt	tmomas
Rich Brown	richb-hanover
Alberto Bursi	bobafetthotmail

4.1.3 Communication within the LEDE Project

One of LEDE's goals is that all project-related communication should be done on public channels that are archived and easily browsable. However, specific problems and tasks may be resolved using direct means of communication. Please look through these choices to find an appropriate means to reach us.

Forum

The LEDE Forum provides a place for direct member-to-member conversations about Installing and running LEDE; Requesting help with development questions; Discussing the documentation; and Publicizing community builds, new packages, and projects that use LEDE. Forum members can follow the discussion via the web, or optionally through email.

Mailing Lists

The project offers the following mailing lists:

- lede-dev@lists.infradead.org - Use this list for submitting patches and general development related work.

- lede-adm@lists.infradead.org - Use this list for project organisational purposes. Anyone can subscribe and read this list, only committers may write to this list.

In addition there are two read-only announcement lists:

- lede-bugs@lists.infradead.org - This list receives bug tracking notifications from Flyspray.
- lede-commits@lists.infradead.org - This list tracks the commits to our *source.git* and *web.git* repositories.

IRC Channels

The project provides 2 IRC channels on freenode:

- #lede-dev - a public channel for everyone to join and participate.
- #lede-adm - a moderated channel that anyone can join but only people with +v flag can write on.

Bug Tracker

Please submit bug reports at https://bugs.lede-project.org/.

Server Status Changes Announcements on Twitter

We will post notices of server outages, maintenance, or other disruption on the lede_project account on Twitter.

Corporate Contact

Please direct general inquiries to lede-contact@lede-project.org to open a confidential discussion with the project developers.

This contact address is primarily intended to find a suitable mode of cooperation and to inquire about project matters without having to disclose your corporate identity upfront. There will be no special treatment beyond this first contact. Please see the [[:rules|LEDE Project Rules]] for further information.

Actual development should happen in public and corporations are strongly encouraged to send their contributions through the public mailing lists or in the form of Github pull requests.

4.2 LEDE Documentation

LEDE is a highly extensible GNU/Linux distribution for embedded devices (typically wireless routers). LEDE is based on the OpenWrt project. Unlike many other distributions for routers, LEDE is built from the ground up to be a full-featured, easily modifiable operating system for embedded devices. In practice, this means that you can have all the features you need with none of the bloat, powered by a modern Linux kernel.

4.2.1 Quick Start Guide

Start here if you are new to LEDE. Find out how to upgrade the firmware your home router to use LEDE and make your network at home much better.

So you want to install LEDE on one of your devices.

The following preparation is recommended, before flashing LEDE firmware:

- Don't rush the installation, take your time. If something seems weird during installation, find answers first before continuing.
- Have your device's precise model name at hand (so you are able to select the correct LEDE firmware)

- Have your devices's documentation at hand, on how to flash new firmware
- When installing and configuring LEDE on your Internet router, your Internet-access will obviously be offline for a few minutes. Please ensure that you have all required information offline or have backup Internet access at hand in this time.

If you have any questions

- browse this (LEDE) site, especially the User Guide.
- feel free to ask in the LEDE Forum.
- you can also consult the OpenWRT wiki, as LEDE is based on OpenWrt. Both projects shares most operational and installation aspects and some content has not yet been migrated.

...and now let's start by installing LEDE on your device.

Installation

There are several installation methods documented in this quick guide depending on the following:

- If your device still has the vendor firmware, follow the *Factory installation* procedure.
- If your device already has an older LEDE or OpenWrt firmware on it, follow the *Sysupgrade* procedure.
    - If your current LEDE installation does not have the web admin GUI installed or if you prefer to upgrade from the command line (upgrade from command line provides more fine-grained control), refer to Upgrading LEDE from the Command Line.
- If you have any questions about this distinction, ask for help on the Installing and Using LEDE forum section before beginning.

Device selection

Devices with >=8 MBytes Flash memory and >=64 MBytes RAM allow a full-featured LEDE installation with GUI.

Devices with 4 MByte or less Flash memory can install LEDE as well, but with a limited feature set. They cannot use optional packages and in some cases may also not have a web GUI, due to limited flash space and may therefore have to stick to command line administration only. The creation of individual custom packages may help to avoid some of these limitations on such 'small' devices, but such a custom-package-creation is not part of this howto.

If you want to purchase a new router for LEDE, stick to devices with >=8 MBytes Flash memory and >=64 MBytes RAM.

Locate and download the LEDE firmware

On the Table of Hardware: Firmware downloads page, locate your specific device. The table of hardware only references stable release versions of LEDE. If you are a newbee, only use these stable release version for first-time device installations; do not initially use a (clearly marked) develop/snapshot version downloaded from other subfolders. This ensures that you get the easiest possible first-time LEDE installation experience.

When you have located your device in this list, click on the "View/edit data" link of the device record. This will open a new page with several details for your specific device. We recommend to bookmark that page, as it has lots of helpful information about your router.

Factory install

On this device-specific **Techdata** page, at the bottom locate the line called **"Firmware LEDE Install URL"** that links to a downloadable file called **"...factory.bin"** file.

Sysupgrade

On this device-specific **Techdata** page, at the bottom locate the line called **"Firmware LEDE Upgrade URL"** that links to a downloadable file called **"...sysupgrade.bin"** file.

Download Troubleshooting

The LEDE download directory structure matches the OpenWrt download directories.

If the Standard Flashing Instructions don't provide the information you're looking for, ask on the Installation Category of the forum or search the OpenWrt site for enough information about your device to find the proper LEDE firmware image.

Find the **Device Page** for your device on the **OpenWrt Table of Hardware** at https://wiki.openwrt.org/toh/start

Find the name and URL of the proper OpenWrt firmware image (factory or sysupgrade).

Then go to downloads.lede-project.org and find the LEDE image from the corresponding directory.

Follow the flashing instructions on the **OpenWrt Device Page**, if needed.

I still cannot find the specified file

Some devices lack an easy installable image and require a special (and usually a bit more complex) installation procedure that is device-specific. This tutorial won't apply for such devices. If you have such a device, locate the corresponding device page in the older OpenWrt wiki and follow the custom installation description (Eventually older OpenWrt info will be migrated to the LEDE tech data pages).

If you can't find your device in the Table of Hardware, or if there is not the file you are looking for, you can consult the "Installing and Using LEDE" Forum for help.

I am in a folder with my device name in multiple files

If you have accidentally browsed the generic LEDE download folders to locate your device, you might see some more download files matching your device. Ignore those other files for your device: you only want the specified file.

Verify the downloaded firmware file

This step is to verify a downloaded firmware binary against a reference checksum to avoid download errors.

This ensures that you have a 100% correct download and that you will not brick your device by applying a faulty download.

> **Warning:** Only continue with flashing if the firmware checksum of your download matches the checksum stated on the download site!

Get the reference checksum

Obtaining the reference checksum from the download page is currently a little inconvenient, as the reference checksums of the firmware binaries are currently not listed on the LEDE device tech data pages.

To get the reference checksum, recall the URL path of firmware binary you just downloaded, e.g. if your firmware download-URL was https://downloads.lede-project.org/releases/version/targets/chipset/modell/lede-something-something-something-something-something.bin then open the web page https://downloads.lede-project.org/releases/version/targets/chipset/modell/

There you will find a list of firmware images, one of it being the file you just downloaded. Now note the additional checksum string on the right side of the download link (in the table column "sha256sum").

We will now calculate a checksum of the downloaded file and compare it with that string. If that check fails, the firmware file was not properly downloaded and if you proceed flashing such a file, you will probably brick the device permanently or require annoying procedures to recover.

> **Warning:** On checksum mismatches, download the firmware file again and compare it again. If the checksum is still wrong in repeated attempts, ask the LEDE forums for help.

Calculate the checksum of the downloaded file

Calculating checksum on Windows

Newer Windows has a built-in tool to calculate sha256sums called 'certutil', but it has no graphical user interface so we will have to use the command line to interact with it.

Older Windows version need to download a sha256 tool, for example MD5 & SHA Checksum Utility (the free version).

To use the built-in certutil, click the Windows icon, type "cmd" and hit enter.

Execute (assuming you downloaded the file to your Downloads folder):

```
certutil -hashfile "%USERPROFILE%/Downloads/LEDE-file-name-here" sha256
```

This will print a checksum like this (file name followed by string with letters and numbers):

```
SHA256-Hash of file C:\Users\USERNAME\Downloads\lede-17.01.1-...-factory.bin:
79 f9 4e fa d3 2c 14 8f f1 95 3f 09 6d 98 c7 41 c0 ff 8f 7e b4 68 8c 9d 5b f9 fb 01
→c0 90 fb ab
```

Remove spaces from this checksum output (e.g. using replace function in notepad):

```
79f94efad32c148ff1953f096d98c741c0ff8f7eb4688c9d5bf9fb01c090fbab
```

Check that the checksum string without blanks matches the one you can find in the **sha256sums** field on the download page.

Calculating checksum on Mac

Mac has an integrated tool to check sha256sums, but it has no graphical user interface so we will have to use the Terminal to interact with it.

Click the Finder icon in the Dock.

Click Applications in the Favorites list.

Find the Utilities folder and click to open it.

Locate Terminal and double-click the icon to open the program.

Open a terminal window, and execute (assuming you downloaded the file on the desktop):

```
shasum -a 256 ./Desktop/file-name-here
```

it will print something like this (string with letters and numbers followed by file name):

```
bba93584fc44045629888e6b147851917cd0c83fcc91a7e6dbe90bdce76 -17.01.0-...-sysupgrade.
↪bin
```

Check that the checksum string matches the one you can find in the **sha256sums** field on the download page.

Calculating checksum on Linux

Linux has an integrated tool that is accessible from command line, similar to Mac.

Some file managers (dolphin and other more powerful ones used in KDE user interface) offer this functionality in the file property window (right-click on the file, select Properties, click on "Checksums" tab, that tab appears only for binary files, like firmware images). It will offer buttons to calculate the SHA256sum and a field where you can paste the SHA256 string from sha256sums file to verify that it is correct.

If your file manager does not offer any of this, you can always use the terminal window and type in the following command (again assuming you downloaded the file on the desktop)

Command line verification:

On the terminal window, execute:

```
sha256sum ./Desktop/file-name-here
```

This will print something like this:

```
1a7c8bba93584fc44045629888e6b147851917cd0c83fcc91a7e6dbe90bdce76 lede-17.01.0-...-
↪sysupgrade.bin
```

Check that the checksum string matches as the one you can find in the **sha256sums** field on the download page.

Troubleshooting

Checksum is not the same

If the checksum process has reported a checksum mismatch, do NOT start flashing, as the download could be corrupt. A corrupt firmware file can brick your device! Instead retry with another download attempt and retry the checksum step.

Checksum is still not the same

If the checksum step fails repeatedly, you can consult the "Installing and Using LEDE" Forum for help. Be sure to include the exact brand, model, and version of your device.

Flash the firmware

Factory install

Connect to the device via Ethernet cable (Only fallback to wireless, if the device has no Ethernet connection options)

Ensure that the LEDE firmware file that you are about to flash, matches your router model and is called **"....factory.bin"**, as you will use it to modify a vendor's **factory** firmware towards LEDE.

> Log into the device's admin web interface and locate the device-specific firmware installation function. Follow the device-specific instructions of your manufacturer's user guide for installing firmware and use this to install the "...factory.bin" firmware file of LEDE.

Wait while the device writes the firmware image to its flash memory. This can take several minutes (the Device Page may state an expected time for this process). At the end, the device will reboot automatically.

The new firmware has been installed. Continue with the next section to check the result.

Sysupgrade

If you want to preserve your existing LEDE configuration, backup the configuration before flashing, by using the web admin GUI menu: (LEDE default IP: http://192.168.1.1) -> **System > Backup/flash firmware** -> **Backup/Restore section > Generate archive**.

If you do not choose to backup, the existing LEDE configuration will be lost and you have to start with a default LEDE configuration after the upgrade.

If you have NAS storage attached to your LEDE device, decide by yourself, whether you require a backup of files on that NAS.

The backup includes config files of manually installed packages but not the packages themselves. After flashing the firmware you will need to install those packages again.

Verify firmware file and flash the firmware

Connect to the device via Ethernet cable (Use wireless only, if the device has no Ethernet connection options)

Log into the LEDE's web admin GUI and in the **System -> Backup/Flash Firmware** menu, go to the "Flash new firmware image" section.

Uncheck/clear the **"Keep settings"** checkbox****!**** (more info regarding the "*Keep settings checkbox*" and it's rare use cases).

Ensure that the LEDE firmware file you are about to flash matches your router model and is called **"....sysupgrade.bin"**, as you will **upgrade** an existing LEDE/OpenWrt system towards a newer LEDE firmware version.

In the **"Flash new firmware image"** section, click **"Choose file"** to select the image file, then click "Flash image...". This displays a "Flash Firmware - Verify" page, containing a SHA256 checksum of the image file just uploaded to the router.

Check that the firmware-checksum displayed on the web GUI matches the SHA256 checksum from the LEDE downloaded page. If it does not match, do NOT continue, as it is a corrupt file and will likely brick your device. Note: If you are upgrading from OpenWRT 15.05, the 32 character displayed is an MD5 checksum, not SHA256. Please verify this MD5 checksum on your operating system before proceeding.

> **Warning:** Careful, this step is as important as the verification of the previous step. Please make sure that the file checksum still matches.

If the checksum matches, click "Proceed". This starts the "System - Flashing ..." along with a spinning wheel and "Waiting for changes to be applied..."

It can take several minutes, while the router uploads the firmware image and write it into its flash ROM and finally reboots.

The new firmware has been installed. Continue with the next section to check the result.

Keep settings checkbox

The "Keep settings" checkbox is a more advanced feature.

If you do not precisely understand the button's use cases, **uncheck "Keep Settings"** every time you flash a new LEDE sysupgrade to your device, to **not** preserve settings.

- Only check the "Keep settings" checkbox on minor LEDE->LEDE bug fix upgrades that are known to not change the config structure
- Only use it for the same firmware channel (release->release, snapshot->snapshot)
- Checking it will preserve several specific config files on the upgrade, but not the whole overlay partition.
- If you flash your device regularly, preferably consider unchecking "Keep Settings" every time you flash the router and instead create a custom installation script for your customization. Example: config-openwrt.sh script.
- "Keep settings" can also be used to preserve own configurations files. To do, go to **System > Backup/Flash Firmware** and open the **Configuration** tab, add your config filesthere and click "Submit". This will allow you to add your custom configuration files to the "'/etc/sysupgrade.conf" file that is read by sysupgrade when it is backing up files. Click "Submit" when done editing.\ To view all files that would be kept when "keep settings" is checked, click the "**Open list...**" button.

Next steps

From here, we will gain access to the new LEDE firmware, through the different methods, and move into making a basic setup.

Installing LEDE Development Snapshots

For experienced users only!

The steps below install LEDE development snapshot firmware on your device.

What is a development snapshot firmware?

Development snapshots are also known as simply "snapshots" or the outdated term "trunk builds". Snapshots are versions of LEDE that are "in development". They are rebuilt frequently, often multiple times a day.

I am a standard consumer, do I want a development snapshot firmware?

No! Although they are the latest version, there is no guarantee that any particular snapshot build will be bug-free, or even work at all.\ Snapshots are not likely to be stable enough to be used on your home router, where you or members of your family rely on the network.\ As a standard consumer stick to the official release versions of LEDE.

Snapshots do not have LuCi web admin GUI installed by default

On snapshots, LuCi has to be installed manually (if needed).

Manual LuCi installation by package may require more free flash storage than a 4MB-flash-device can handle, see 4/32 device warning

To manually install LuCi: LuCI installation

TL;DR: opkg update ; opkg install luci ; /etc/init.d/uhttpd start ; /etc/init.d/uhttpd enable

This should get a working GUI that repsonpds to http://192.168.1.1 requests by a browser, mind you I did not actually test that...

Installing a LEDE Snapshot

To install (or "flash") a LEDE snapshot firmware image, just follow the standard flashing instructions: Factory install and Sysupgrade, with the only difference to use it for a firmware file from the snapshot download section.

Setup

Once you have a brand new installed LEDE device, the first step is to gain access to it. Depending on the image you used, it may or not have Web Interface.

- If you used a released image, they come with LuCi by default (the web interface).

- If you used a development image, they don't come with LuCi, so please proceed to gaining access through SSH.

After gaining access, we will setup the basics for having internet access and WiFi.

Accessing the LEDE web admin GUI

LEDE has a web admin GUI called "LuCi".

- If your LEDE device has been configured as a router or gateway with default settings, LuCi is listening on your local IP subnet's default gateway address http://192.168.1.1.

- If your LEDE device has been configured as WiFi access point, network client or switch, LuCi's address depends on the IP address you have manually configured for your LEDE device. You can also try, to use a local network scanner or your regular router's status page to find out the device IP address.

You need to use the "root" password to successfully access LuCi, 'root' is the default admin account of your LEDE device. On a freshly installed LEDE device, there is no password set yet for the 'root' account, you can just enter right away.

Go to the System->Administration page and define a new password in both fields, then click Save and Apply (at the bottom of the page).

If you are unable to access your LEDE device, due to messed up IP address/root password configuration, refer to the troubleshooting section of the User Guide, to reset the LEDE device's settings.

This has verified that you can successfully use the LAN ports of your LEDE device. You now have a working LEDE device in its initial default configuration.

Troubleshooting

For this check only use an Ethernet cable, as WiFi is by default only enabled for devices that do not have Ethernet ports

If you have flashed a development/snapshot firmware of LEDE, you first need to manually enable the admin web GUI: development installation guide. Or verify the result on snapshot builds by SSH-connecting to your LEDE device IP 192.168.1.1

You can consult the troubleshooting section of the User Guide, if you think that resetting LEDE's settings might help.

You can consult the Installing and Using LEDE forum section, if something went wrong. Please provide specific details of your device and what you did so far and what you have attempted to fix it.

Do not worry, if the 5 GHz WiFi does not seem to start immediately after having enabled it. It might be busy for 1-10 min scanning for weather radar, see basic WiFi setup for more background info.

Note that you can always run ''logread'' on the SSH command line, to gain more insight into what the device is currently doing or to diagnose any kind of problems.

If needed, you can also take a look at Troubleshooting Internet Connectivity.

If you have flashed a development/snapshot firmware of LEDE, you first need to manually enable the admin web GUI: development installation guide. Or verify the result by SSH-connecting to your LEDE device IP 192.168.1.1

The router may have succeeded, but gotten a different IP address than you expected. Either scan your local network, check your regular router's status page (to find out about the IP address it has assigned to your LEDE device) or use failsafe mode, to manually reset LEDE's settings (which includes the network settings)

If you have checkmarked the "Keep settings" checkbox in the previous section and the system fails to boot after flashing, you need to consult the failsafe mode, to manually reset all settings.

SSH Access for Newcomers

A LEDE device

- always has SSH command line access (on port 22)
- may also have a web admin GUI (on http port 80, and if enabled also on https port 443)

To "ssh into your router", you enter the command ''ssh root@192.168.1.1'' in a terminal emulator (for a router whose address is 192.168.1.1). The first time you ssh into your router, you will probably see a warning about the //RSA key fingerprint//. If you are certain this is the address of your LEDE router, simply type ''yes'' and press Return. Then enter the password you have given to your router, or press Return if this is the initial setup. Here is an example session:

```
$ ssh root@192.168.1.1                                             <==␣
→You type this
The authenticity of host '192.168.1.1 (192.168.1.1)' can't be established.
RSA key fingerprint is SHA256:4VbDA/MOc7inPiyllF5f0r3Q6iEx89ddKdhLGBovsiY.
Are you sure you want to continue connecting (yes/no)? yes          <==␣
→and this
Warning: Permanently added '192.168.1.1' (RSA) to the list of known hosts.
root@192.168.1.1's password:                                       <==␣
→and the password here

BusyBox v1.25.1 () built-in shell (ash)
```

```
      _____
     /        /\          _     ___   ___   ___
    /   LE   /  \        | |   | __|   \|  __|
   /    DE  /    \       | |__| _|| |) |  _|
  /_____/  LE  \      |____|___|___/|___|
  \        \  DE  /                                        lede-project.org
   \   LE   \    /      -----------------------------------------------------
    \  DE    \  /         Reboot (17.01.2, r3435-65eec8bd5f)
     _____\/        -----------------------------------------------------

root@LEDE:~#                                                                  <==␣
→type next command here
```

To end your //ssh session// to your router, type ''exit" and press Return.

The remainder of this page describes several terminal emulators that Windows, Linux, or macOS can use to access your LEDE router.

Windows Terminal Emulators

Cmder, Smartty, Putty, and WinSCP are terminal emulators that allow you to ssh into a router.

Using Cmder

Cmder for Windows is an open-source terminal emulator that runs on Windows. It is free to use and provides an easy "comman

- Download cmder from http://cmder.net/

- Unzip the *cmder.zip* file

- Open the Cmder folder, and double-click the Cmder icon. You'll see a Cmder window open similar to the image below.

- To ssh into the LEDE router at 192.168.1.1, type ''ssh root@192.168.1.1'' then press Return

Using Smartty

Smartty gives you command line access to LEDE and allows you to open/edit/download/upload files in LEDE, and is overall more modern and user-friendly than Putty (another tool detailed below):

- Download Smartty from http://smartty.sysprogs.com/: choose "download" for the installer, or "portable version" if you want it as a standalone program that works without installation.

- after installation or after unzipping the archive, doubleclick on **SmarTTY** executable file.

- You will be greeted by a window with two choices, doubleclick on "setup a new SSH connection" (the other option is for serial connections, for usb-TTL dongles and somesuch you connect to the device's debug serial pins on the board, we won't use that now).

- The window changes into the SSH setup, write the following info: - **Host name:** LEDE device IP address (default is **192.168.1.1**) - **User Name: root** (this is the "administrator" and only user in default LEDE) - **Password:** leave this blank for your first connection, then write the password you set up (either in Luci GUI or after your first SSH access)

- Click "Connect" button at the bottom, and you will now see a big terminal screen coming up

- A default LEDE firmware lacks the server component to allow you to open/edit/view/upoad/download files in Smartty, so after you have connected to the internet write ''opkg update && opkg install openssh-sftp-server" to install it. If the next step fails, it might be necessary to reboot the LEDE device for this new service to start up properly.

- Now you can click on **File -> Open a Remote File** to open a popup that shows the filesystem of the LEDE device, and you can navigate in it and open text files for example as normal (they will open in a SmarTTY text editor window)

- If you want to upload or download files to/from a specific folder in the device, you can click on SCP menu and choose the most appropriate action from there.

After the first time you connected to a device, Smartty saved a profile, so you can connect again to the same device (at that IP address with that password) by just doubleclicking its icon on the first window you see when starting Smartty. You can right-click on this profile icon to edit it again, if needed.

Using putty

Putty gives you command line access to LEDE:

- Download Putty from http://www.putty.org: Simply get the 32bit ''putty.exe" download from the ''Alternative binary files" section.

- Start ''putty.exe" on your Windows client -> Putty's login window pops up.

- go to the''Session" category of Putty's login window, look for the field ''Host Name (or IP address)" and simply enter the IP-address (e.g. **192.168.1.1**) of your LEDE device, keep the default provided port **22**.

- Click the ''Open" button at the Bottom to open a connection. This will pop up a shell windows, asking to ''login as''. Login as **root** with the LEDE password you have defined some time before. If you have not yet set a password yet on "root", you will not be asked for the password.

- Done, you are logged into the LEDE command line.

Using WinSCP

WinSCP allows you to browse the LEDE file system in Windows Exlorer like GUI-style:

- You have to install the SFTP server on the LEDE side first, as WinSCP needs that to connect successfully. On the putty command line (see previous section) execute:

  - ''opkg update''

  - ''opkg install openssh-sftp-server''

- It usually is not required at this point, but for the sake of simplicity of this howto, reboot your LEDE device now, to make sure the SFTP service really starts up

- Download WinSCP from https://winscp.net/eng/download.php, get the non-beta ''Installation package" or ''portable executables" and install or unzip them on your Windows client

- Start ''WinSCP.exe" on your Windows client, WinSCP's login window will pop up

- Click on ''New Site" on the left, then enter your LEDE device IP address (192.168.1.1) on the right side into ''Host name'', keep the default port "22''. In ''User name" enter **root**, in ''Password'', enter your root **password** (or leave blank, if you have not set a password yet)

- Click the ''Login" at the bottom of the Window.

- Done. You now have an Exlorer-like view of your LEDE filesystem.

Editing LEDE config files with WINSCP's integrated GUI editor:\ To edit a LEDE config file with WinSCP's GUI-based editor, just right-click the file in WinSCP and select ''Edit" from the context menu.

Linux Terminal Emulators

All Linux distributions provide a command-line ssh client as part of the default installation.

- Open a terminal emulator and write *ssh root@192.168.1.1* ("ssh" is the command, "root" is the LEDE user you are connecting to, and "192.168.1.1" is LEDE default IP)

- there will be a message about accepting a new key from the LEDE device, write "yes" and press Enter key.

  - If for some reason you have reinstalled LEDE the device will have a different key and you get an error about key mismatch. The error will state what is the command line to copy-paste in your terminal to delete the old key and proceed.

- if you want to close the session, write "exit"

Linux also usually has SCP clients (to open/edit/download/upload files in LEDE), which may or may not be installed by default. You need to look up your distro's documentation or search with your package management interface for "SCP" to find where it is and its current installation status. Read its integrated manual ("man scp" for example is for the command line SCP client) or google some tutorials to learn how to use it.

macOS Terminal Emulators

On macOS (formerly Mac OSX) any terminal emulator will allow you to ssh. There several terminal emulators:

- Terminal - The macOS built-in terminal program. Find it in /Applications/Utilities

- iTerm2 https://iterm2.com/ a much-enhanced terminal program. Donation-ware - it's worth it.

To ssh into your LEDE router at 192.168.1.1, type ''ssh root@192.168.1.1'', then press Return.

Connecting to the Internet

For a first quick Internet access test: If you have an existing router, connect the WAN port of your LEDE device to a LAN port of that router and confirm internet connectivity of your LEDE device with the following steps:

- In the LEDE admin web GUI, go to Network -> Diagnostics and Click on "ping" button

- or, if using LEDE SSH command line, you can use the command ''ping lede-project.org''

- This should return "0% packet loss" if everything is allright with your Internet connection.

Use the following steps if you can connect to your LEDE router's Web GUI, but cannot connect to the broader Internet (say, www.google.com).

Verify that the WAN connection of your router (usually Ethernet) is connected to your cable/DSL modem, or other device that's connected "to the internet".

Check to see if your LAN and WAN ports are in the same address range. To do this:

- Go to **Network -> Interfaces**

- Find the IPv4 address assigned to the **LAN** interface

- Find the IPv4 address assigned to the **WAN** interface

- If these two addresses are in the same range, e.g., if they start with the same three sets of numbers, then they are in the same address range. You need to change the address of the LAN interface (see next step).

- If the address ranges do not conflict, then ask on the LEDE Forum for more help.

Change the LAN interface address, if necessary. To do this:

- From the **Network -> Interfaces** page, click the **Edit** button next to the LAN interface.

- The "IPv4 Address" field will show the LAN address found above.

- Enter a new address, that differs from the WAN address. For example, the LAN address after a fresh LEDE installation will be "192.168.1.1''. A good alternate address would be "192.168.2.1''.

- Change the field to the new address, then click **Save and Apply** at the bottom of the page.

- Write the new address on the sticker that you placed on the bottom of your router. (This will save you or your techie friend a ton of time next time you need to work on the router.)

After changing the address, you will need to enter the *new address* in your web browser. You should get the LEDE login page again.

If you can now access the internet (e.g., www.google.com), you're all set.

If you still cannot access the internet, then ask on the LEDE Forum for more help.

Setup the WiFi

Decide, whether you want to use LEDE as switch, router or gateway

When using your LEDE device as a WiFi access point, remember to initially set your country code in the LEDE WiFi configuration, to properly comply with your country's WiFi legal regulation!, e.g. see here for a first basic WiFi setup.

Consult the User Guide for more advanced configuration.

Install custom software packages that you might be interested in. Or, if you had LEDE before, reinstall the custom packages that you had before the sysupgrade, by using ''opkg''. If any package installs a system service, you also need to enable the corresponding service according to your needs.

If you have chosen to backup your previous LEDE config before flashing, you can now restore it, using LuCi's **System > Backup/flash firmware** menu. Otherwise you need to start configuring from scratch.

Set your country code in the LEDE WiFi configuration to comply with your country's WiFi legal regulation, e.g. see in basic WiFi setup.

Optional Next Steps

Once the snapshot is installed on your device Install LuCI, if required

Consult the User Guide

Install other packages with *opkg install* .... You should definitely install the SQM-QoS package to minimize lag/latency. Use *opkg*

- Other useful packages are snmpd, netperf, and any of your favorites.

If you have an unbranded / low-end / low-cost router that came shipped with OpenWrt / LEDE, you can find out the architecture it is using by connecting to it over ssh and opening */proc/cpuinfo*. A combination of the *system type* and *machine* is what you are looking for.

If you will be flashing LEDE snapshot firmware frequently, you can create a script that makes configuration changes in a reliable and repeatable fashion. See, for example, the config-openwrt.sh script that updates most settings.

Setup a Wi-Fi access point on your LEDE device

Devices that have ethernet ports have Wi-Fi turned off by default. This is a basic description, how to enable a first WiFi network and most important, how to properly configure your country code such that your WiFi network complies with the legal regulation of your country.

On web admin GUI

- Open the admin GUI on http://192.168.1.1

- Login with your "root" password

- Go to the menu Network → Wireless. This page list a separate WiFi configuration section for each of your pysical radios, (many devices you will have a first radio for 2.4 GHz and a second one for 5 GHz).

- For each of your radios, you can create a WiFi network by clicking ''Add'':

  - On the first WiFi network that you configure, go to the **Device Configuration** and open the tab **Advanced Settings**: in the ''Country Code" field, select the correct county code, where your LEDE device is installed. This is important to ensure your LEDE device meets legal regulations in your country. (all other configured radios will use the same device settings)

  - For each WiFi network, in the "Interface Configuration" section, configure your WiFi settings, at least customizing the following settings:

    * In the tab **General Setup**, define a custom ''ESSID" (the name of your WiFi network)

    * In the tab **Wireless Security**, activate some ''Encryption" (e,g, "WPA2-PSK")

    * In the tab **Wireless Security**, activate a ''Cipher" (e.g. "Force CCMP AES")

    * In the tab **Wireless Security**, in ''Key'', define a personal secret phrase, which clients need to use, to successfully connect to your WiFi network.

    * If needed, configure further settings according to your needs. often the default settings like **auto** are sufficient for general usage.

- Click ''Save & Apply" when done.

Troubleshooting:

- If you have configured 5GHz WiFi and have just enabled it, but the 5 GHz WiFi does not seem to start up, consider the following: If your device supports WiFi channels > 100, your LEDE device first must scan for weather radar on these channels, before you can actually use such channels for WiFi. This may take 1-10 minutes onetime after first reboot depending on your WiFi situation and depending on the number of device-supported channels > 100. You may also experience 1 minute delay on each automatic channel change, as the same scan delay is required for regulation compliance.

On SSH command line

This is not a complete howto, to create a WiFi network on the command line.\ It just shows you the important step, to initially set your country code for proper WiFi on the command line, to meet legal regulations of your country:

- Connect with SSH to your LEDE device.
- Execute ''uci show wireless'' to see all the wireless configuration and how many Wi-Fi chips (called "radio" in the config) there are on the device
- Find out your country in a list of ISO/IEC 3166 alpha2 country codes. There is a list on the wikipedia article about ISO 3166-1 alpha-2
- Execute ''uci set wireless.radio0.country='XX' '' to set the country code XX for radio0 device, and adjust this command to set the same country code for all wireless radios in the device.

LEDE Starter FAQ

Ok, so I've successfully flashed LEDE on my device. what should I do next?

Set an initial root password, setup WiFi, get familiar with the troubleshooting/rescue options in the user guide, then browse the user guide for further config you may be interested in.

How do I access the web admin GUI on a default installation?

Open http://192.168.1.1 or http://lede in your favorite web browser

What is the default admin username in LEDE?

"root"

What is the initial password for root?

There is no initial password set. Please set one manually, after your first login, either by using ''passwd'' on the command line or in LUCI Menu System/Administration

Can I reset the 'root' password, in case I have forgotten it?

Yes, check the troubleshooting section of the user guide.

I seem to have messed up the LEDE device configuration, my LEDE device is no longer accessible. What do I do?

Check the troubleshooting section of the user guide, several recovery options are available.

How can I enable SSL for the web admin gui?

In an SSH-command line, run ''opkg update'', then install the package ''opkg install luci-ssl'', then restart the router. Then you can access https://192.168.1.1 or https://lede with your favorite web browser

Is there a command line editor available in SSH?

use *vi*. It's most important key shortcuts are:

——— ———————————————- ESC :q! exits without saving ESC :wq exit and save ESC i insert text at the current cursor position ESC x delete the character under the cursor ESC dd delete the whole current line ESC o open new line below cursor ESC O open new line above cursor ——— ——————————————-

What other tools can I use for administration of LEDE from a windows client?

Get Putty for SSH access to LEDE and get WinSCP as a file browser. For WinSCP to connect successful, you have to first ''opkg update'' then install the package ''opkg install openssh-sftp-server''. You can then use WinSCP to click through the LEDE file system and use its GUI editor for editing LEDE config files.

I would like to customize LEDE, but am having difficulties finding the packages that I am interested in.

Remember to first run ''opkg update'' once after each LEDE reboot, to refresh the list of available packages. LEDE will only temporary store the retrieved list in a temp RAM filesystem, losing the list of updates on every reboot.

Why is there a "WAN" and a "WAN6" and a "LAN" interface in LEDE, but no "LAN6" ?

Note that there is a "WAN" and "WAN6" interface. Each of the 2 WAN interfaces holds config data related to the upstream interface (WAN is for IPv4 and has "DHCP client", while WAN6 is for IPv6 has "DHCPv6 client"). On the other hand "LAN" has both the config data for the downstream side for both IPv4 and IPv6 associated, so there is no need to have an extra LAN6 interface. Also note that both an interface and a zone called "LAN" exist. Also "WAN" is used both as a name for a zone and as a name for the IPv4 WAN interface. Both the "WAN" and "WAN6" interface belong to the "WAN" zone (so furthermore there is no "WAN6" zone)

Why is there both a "Save & Apply" and a "Save" button in LuCi?

You can do several different changes in different tabs, each time clicking "Save" without committing the changes. You can then use "Save & Apply" to commit all of those changes in one transaction.

What is the difference of total available memory, free and buffered shown in LuCi status overview?

Total = free + buffered. Buffered = memory that is temporarily in use to handle I/O operations Free = really free memory

4.2.2 User Guide

Start here if you already have LEDE running on your router. LEDE has hundreds of optional packages that give you VPNs, VLANs, and other capabilities.

4.2.3 Developer Guide

Start here if you want to create custom builds of LEDE or contribute to its development. There are a large number of tools that make the development easy.

4.2.4 Where can I learn more?

The three guides above (Newcomer, User, and Developer Guides) have links to virtually all the information about LEDE contained in this documentation. However, you may find more support in

Endorsements

The *Wrt community is made up of many great communities all tinkering on their own mission in improving something on this planet. The Following communities have kindly decided to endorse this project. Thanks !

	qMp endorses the LEDE project
	"We wish huge success to the LEDE project"
	Weimarnetz Project Homepage
	"We . . . will consider it the new default OS environment for embedded devices running bmx6 and bmx7"
	"We endorse the LEDE project and we plan to start basing Libre-Mesh releases on Linux Embedded Development Environment"
	"We deeply appreciate the efforts of the LEDE project . . . "