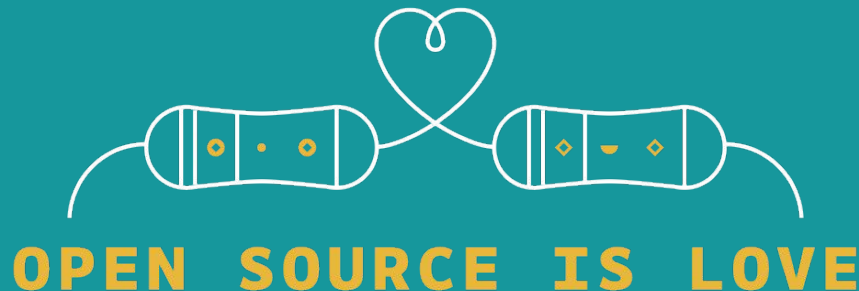# Arduino
Open Source Report 2022

Another busy year has passed in the Arduino world, and it's about time to publish our annual retrospective on the Arduino open source ecosystem.
In this report you'll learn about the activities of the **Arduino team** from the past year, as well as the contributions from our passionate and vibrant **community**.

This report is a snapshot of the ecosystem as of December 31st, 2022.

OPEN SOURCE IS LOVE

Introduction

One more busy year

In the last yearly report we described 2021 as **one of the busiest and most productive years** in Arduino history in terms of open source development. Well, **2022** hasn't been much quieter.

The Arduino team has been releasing new important **open source projects**, both **hardware and software**, while the community has been releasing and maintaining **libraries** at an incredible pace.

Just to name one big release, the **IDE 2** was released this year. For Arduino, such an incredibly complex project has been a massive investment in financial terms and we are proud of the very positive reception by the users and the active participation of contributors. We're seeing a healthy community and this can also be seen from many indicators that are not in this report, including participation in the Arduino Day yearly celebration as well as the forum activity and much more.

To comment on this report, join us in the Arduino Forum.

Some challenges for the future

The Arduino community and user base is constantly growing, involving more novice users on one side and more professionals on the other side. As an open source project, we have a lot to do to keep improving our ecosystem according to our mission. These are just some of the main challenges that we'll need to address:

- **Interoperability** – How do we ensure that most libraries work on all architectures, avoiding hard-coded architecture-specific code? How can we improve the core API so that libraries (and users) can rely on a stronger abstraction layer?

- **Security** – How do we improve security across libraries and tools?

- **Official libraries** – How do we involve community contributors in the maintenance of official libraries and cores? How do we promote a community library to an official library?

How to support the Arduino project

There are several ways to support the Arduino team:

- **Buy original Arduino boards** (their cost funds our investment in open source development for the benefit of the entire ecosystem, including other hardware manufacturers)

- **Subscribe to an <u>Arduino Cloud</u> plan** (for a few $/month you can fund our open source development and also get web dashboards, smartphone app as a remote control for your projects, remote firmware upload, variable synchronization across devices and more)

- **Make a <u>donation</u>**

- Join the development and **<u>become a contributor</u>!**

But in addition to the Arduino team, do not forget to **support the authors of your favorite libraries**. Many of them accept donations through GitHub or other means, and all of them appreciate your gratitude in any form.
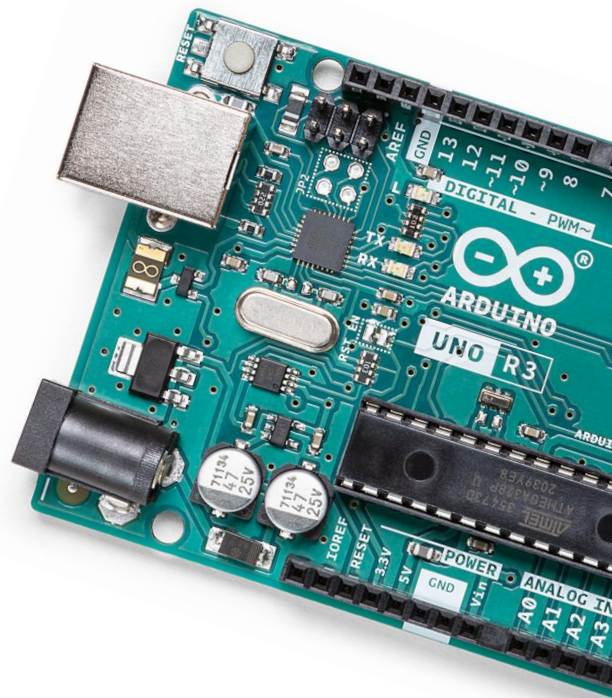
# Activities carried out by the Arduino team

In this section we'll go through the main projects delivered directly by the Arduino team.

New Open-Source Hardware boards

During this year we released **THREE new open-source hardware products**:

Make Your UNO Kit
Nano 33 BLE Sense Rev2
Screw Terminal Adapter for Nano

For each of them, the full schematics and CAD files are available on the docs.arduino.cc website which also contains **web-based interactive viewers** that let users see the 3D models and click on individual components to browse the BoM interactively and see part numbers and other details.
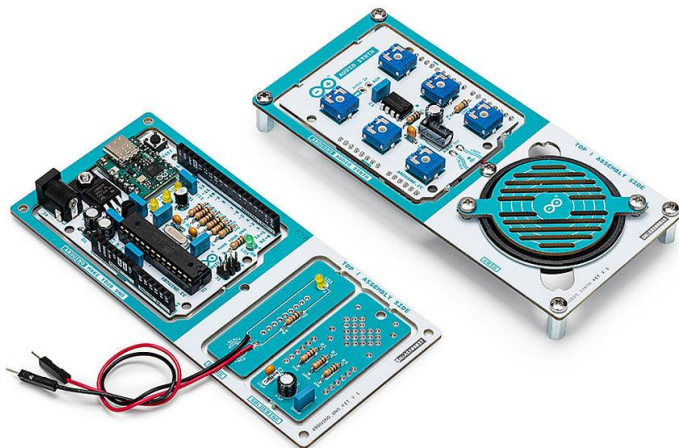
HOW TO GET INVOLVED:

- **Remix these boards, innovate and share your builds!**
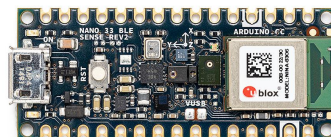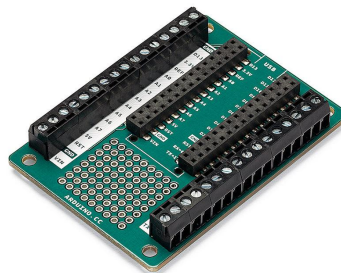
Arduino IDE 2

An important milestone was reached in 2022: the **Arduino IDE 2.0.0 stable was released**!
Rewriting the Arduino IDE from scratch is the most complex project we have been working on. A dedicated team has been working on this full-time for more than three years, helped by the many contributors. The IDE 2.0 brings **improved user experience**, moves away from Java, and brings new features such as **autocompletion**, **code navigation** and **debugging** as well as a much improved **serial plotter** and far more.
In 2022, 14 new versions were released before and after the 2.0.0 stable, localized in 17 languages.

HOW TO GET INVOLVED:

- **Test the IDE 2 to spot issues and bugs**
- **Contribute the translation in your language**
- **Join the development and help testing bugs, fixing them and developing new features!**
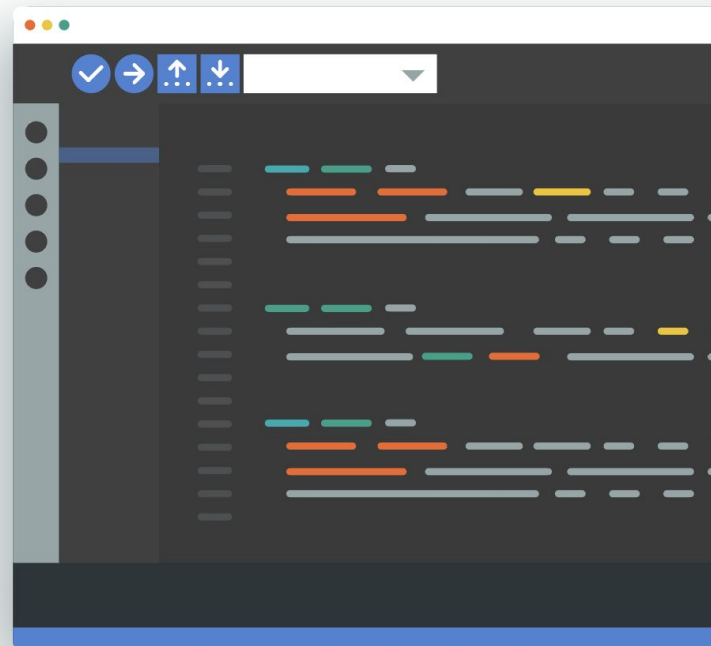
Arduino CLI
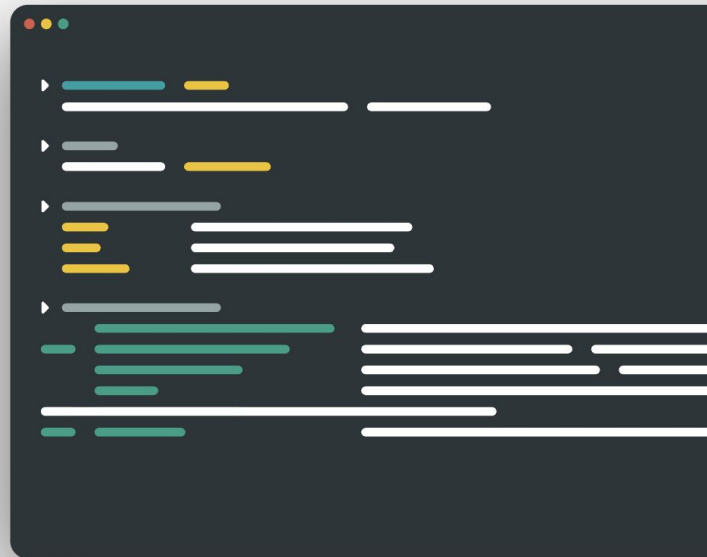
The open-source Arduino CLI command line tool provides access to all the features of the IDE, including compilation, upload to boards, library management and more. This tool allows you to manage your Arduino sketches without leaving your editor of choice, as well as integrate it in your scripts and custom applications.

We have been working on this tool on a daily basis, and during this year we released 12 new versions!

HOW TO GET INVOLVED:

- **Contribute the translation in your language**
- **Jump into the development and help testing bugs, fixing them and developing new features!**

Arduino Cloud CLI

This new open-source tool was released to allow managing Arduino Cloud resources from command line. Among other things, the tool supports device provisioning and Over-the-Air updates: combined with Arduino CLI this allows anyone to upload sketches on remote devices without leaving the command line.

HOW TO GET INVOLVED:

- **Help testing bugs, fixing them and developing new features!**
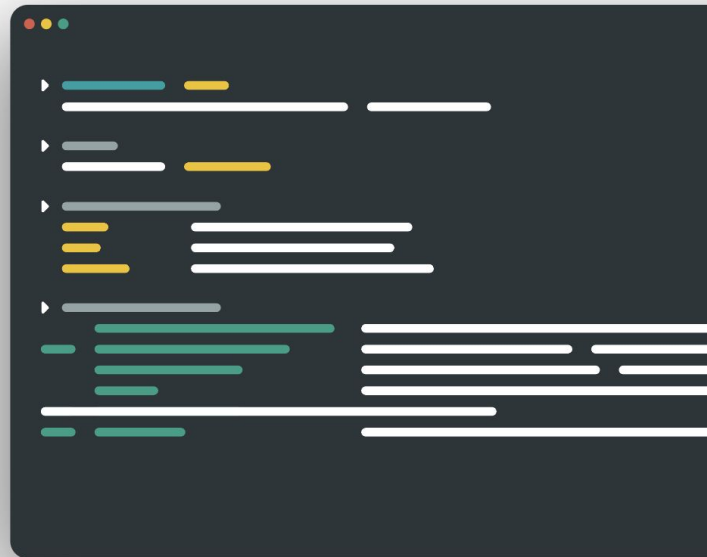
Arduino Lab for MicroPython

A new IDE for MicroPython was developed and released, in collaboration with Murilo Polese. This new cross-platform application supports any board with a serial REPL interface, allowing anyone to play with MicroPython in a simple way.
This is an experimental project we're sharing with the community to understand what the next steps should be.

HOW TO GET INVOLVED:

☞ **Test the application in real-world situations and report feedback**
● **Join the development and roadmap discussion on GitHub**

Official libraries

5 new official libraries were developed and published:
- Arduino_BMI270_BMM150
- Arduino_HS300x
- Arduino_Braccio_plusplus
- Arduino_MultiWiFi
- Arduino_Threads
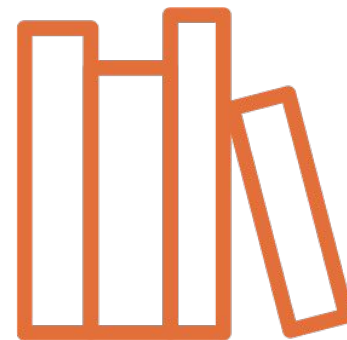
In addition, during 2022 we performed **42 new releases** of the official libraries with bug fixes and new features.

HOW TO GET INVOLVED:

- **Official libraries are so many that we really need help from the community, so you're more than welcome to help us fix bugs, review pull requests and improve the examples shipped with libraries to better document their functionality!**

Official cores

During 2022 we performed **13 new releases** of the official cores for AVR, megaAVR, SAMD, RP2040, STM32, nRF52 with bug fixes, new features and support for more boards.

In addition, a new version of the **ArduinoCore-API** abstraction layer was released.
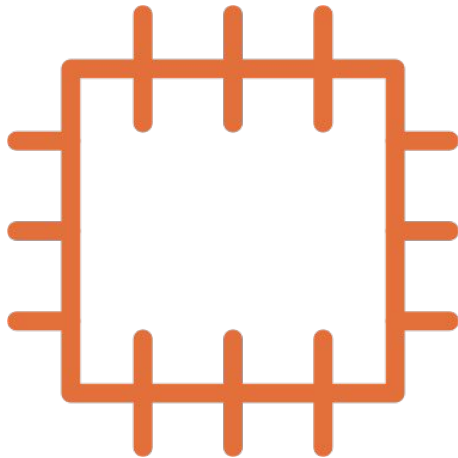
HOW TO GET INVOLVED:

- **There are still many pending issues and feature requests, so you're really more than welcome to help us in GitHub.**

Project Hub

In 2022 we reimplemented [Project Hub](#) from scratch in order to make it more user friendly and maintainable. All the contents were of course migrated to the new platform.
Project Hub is the community-maintained repository of Arduino projects, hosting **thousands of open-source projects** documented with sketch code and bills of materials.
The new platform is entirely under the control of the Arduino team which will allow faster iterations and new features.

HOW TO GET INVOLVED:

- **Share your projects in Project Hub to show the community what you've done! Just take some pictures, write a step-by-step guide and attach your code to inspire other makers.**
- **Join the [forum](#) to discuss the development roadmap of Project Hub.**
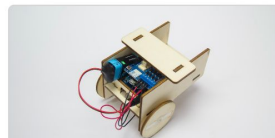
Security

Last but not least, a lot of work has been carried out by our security team that works full-time to inspect code, handle reports, and secure the infrastructure including the way assets are developed, compiled and distributed. Even if this activity does not manifest itself in the form or releases, it's been a consistent part of our work in 2022.

HOW TO GET INVOLVED:

- **Help us inspect repositories to find vulnerabilities, and get in touch with our security team according to the security policy.**

Language discussion space

In order to support the development and continuous improvement of the "Arduino language" we launched a dedicated GitHub repository which hosts a Discussion space. That's the place where every suggestion about improving the core API should be directed, and that's where the maintainers of the many Arduino cores can coordinate to standardize their APIs.
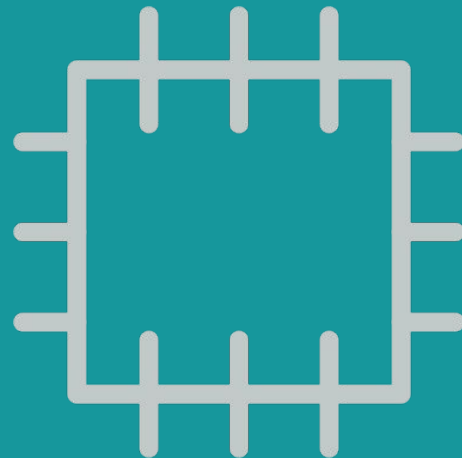
☞ HOW TO GET INVOLVED:

- **Join the discussion and help standardizing the Arduino APIs!**

Multitasking

To inaugurate the new Arduino language discussion space we launched the debate about an important topic: how do we standardize multitasking support to Arduino?
Along with defining problem and requirements, we proposed an initial implementation by the Arduino team that the community has been discussing.

HOW TO GET INVOLVED:

- **Read the blog post and join the discussion!**

Highlights from the community

We're now going through the main contributions from the community in 2022.

+24%

YoY new libraries

Community contribution matters
1.042 new contributed libraries have been added to the Library Manager (more than last year!), bringing the total number to **5,491**. This means the Arduino library ecosystem is having an impressive growth.

Libraries are a vibrant big thing

This number represents the incredibly active and continuous efforts of the Arduino library developers.

5781

New versions of libraries in 2022

You will never walk alone

421 new open-source tutorials were added to Arduino Project Hub during the year. (Note that we perform quality review and moderation to avoid duplicates, so this number does not include all the submissions but only represents the projects that were approved and published by the Project Hub maintainers.)

6600

INTERACTIONS

The community is more active than ever

This number represents the number of people interactions on the official Arduino repositories on GitHub reporting issues or submitting pull requests.

Many cores contributions

+84 new versions of contributed Arduino cores were released during the year.

(Note that since there's no official platform registry, this number may not include platforms that we don't know about.)

Top contributors of new libraries

Author	Number of libraries added in 2022
DFRobot	78
Khoi Hoang	66
Rob Tillaart	46
M5Stack	34
RLL-Blue-Dragon	32
RFtek Electronics	24
RAKWireless	20
SparkFun Electronics	15
@chrmlinux03	13

Author	Number of libraries added in 2022
Adafruit	11
AlexGyver	8
Gunce Akkoyun	8
Narwhalsss360	8
Turkish Technology Team Foundation	8
SRA	7
Stefan Staub	7

Author	Number of libraries added in 2022
David Such	6
Philip Fletcher	6
STMicroelectronics	6
Centaq	5
Debinix Team	5
Milos Petrasinovic	5
Sensirion	5

Most active library maintainers

Maintainer	Number of releases in 2022	Maintainer	Number of releases in 2022	Maintainer	Number of releases in 2022
Khoi Hoang	566	Wolfgang Ewald	65	Brian T. Park	37
Rob Tillaart	435	David Lloyd	57	hideakitai	36
Adafruit Industries	344	stm32duino	48	Rei Vilo	35
Mobizt	189	Asuki Kono	47	Peter Polidoro	30
SparkFun Electronics	152	Turkish Technology Team Foundation (T3)	45	RAKWireless	30
AlexGyver Technologies	137	Gunce Akkoyun	44	@chrmlinux03	29
M5Stack	83	Renzo Mischianti	41	Andreas Taylor	27
Brian Taylor	79	Simone Salerno	39	NAP-Software	25
RLL-Blue-Dragon	70				

(This ranking is based on the frequency of releases, which does not necessarily reflect the complexity of each release.)

More contributions

The Arduino community is much more than this, and given its size it is nearly impossible to track all the contributions that are shared daily in **unofficial community platforms** and **independent websites**. This includes **software contributions** such as code examples and full open-source sketches, but also **knowledge contributions** such as documentation and tutorials, and last but not least **hardware design contributions** such as derivative or complementary products (shields, accessories, derived boards).

Tracking and representing such a variety in a future edition of this report, both in quantitative and in qualitative form, would be a valuable addition to recognize the tremendous efforts of thousands of people and companies contributing to the success of the Arduino ecosystem.

That's a wrap
Thank you!

The Arduino Team

Interested in joining the Arduino team? **We're hiring**.