

THE GLOBAL DEVELOPER POPULATION 2019

How many developers are there?



About SlashData

SlashData is the leading analyst company in the developer economy, tracking global software developer trends based on more than 40,000 software developers annually in over 160 countries. Our surveys track the changing landscape of mobile, IoT, desktop, cloud, web, AR, VR, games, machine learning developers and data scientists.

SlashData Ltd.
19-21 Hatton Gardens
London, EC1N 8BA
+44 845 003 8742

<https://www.slashdata.co/blog>
Follow us on Twitter: [@SlashDataHQ](https://twitter.com/SlashDataHQ)

**We help the world
understand developers
– and developers
understand the world**

/DATA



License terms

Definitions

Research: The current publication, a SlashData research report or data dashboard, including the credentials (username and password) used to access the data dashboard, if included.

Client: The Organisation which has purchased this Research.

License Holder(s): All employees of the Client's organisation.

Who can access this research? This research is licensed enterprise wide to the Client organisation.

Subject to the terms and conditions of this License, SlashData hereby grants Client a limited, non-exclusive, non-transferable, enterprise-wide License to the Research analysis, findings, data tables, and charts contained in this Research. Client and the License Holder(s) may only distribute this Research internally within their organisation.

How many users can use the data dashboard? Up to 2 simultaneous users

In the case of a data dashboard, the credentials can only be used by up to two License Holder(s) per License at any given time (2 simultaneous users). If you try to login while two of your colleagues are already using the service, a pop-up message will appear giving you the option to either cancel your login or force one of your colleagues out of their dashboard session.

Can I share this research publicly? Email hello@slashdata.co to request permission to share any of this research publicly.

Client and the License Holder(s) may not distribute the Research publicly, or make it available to any other organisation or third party, or to any publicly accessible internet resource (such as a public website, Twitter, Dropbox or Slideshare) unless a written permission is granted by SlashData. Additionally, this License does not provide any right to sub-license the Research to other parties.

Please contact hello@slashdata.co with your request to share this Research analysis, findings, data tables or chart(s) in any public form, including but not limited to conference presentations, client presentations, or supplier meetings.

The Small Print

SlashData believes the statements and data contained in this Research to be based upon information that we consider reliable, but we do not represent that it is accurate or complete and it should not be relied upon as such. Opinions expressed are current opinions as of the date appearing on this publication only and the information, including the opinions contained herein, are subject to change without notice. Use of this Research by you or any permitted third party for whatever purpose should not and does not absolve you or any such third party from using due diligence in verifying the publication's contents. SlashData disclaims all implied warranties, including, without limitation, warranties of merchantability or fitness for a particular purpose.

SlashData, its affiliates and representatives shall have no liability for any direct, incidental, special, or consequential damages or lost profits, if any, suffered by any third party as a result of decisions made, or not made, or actions taken, or not taken, based on this Research

This License and the rights granted hereunder will terminate automatically upon any breach by the License Holder(s) of the terms of this License.

This is Syndicated Research, not Work for Hire

Client or the License Holder(s) will obtain no rights in any underlying processes, software, trade secrets, trademarks, patents, or any other intellectual property or proprietary rights owned by SlashData that are or may be used by SlashData in or in connection with the creation of the Research. The Research is not "work made for hire," and SlashData does not assign to License Holder(s) and retains for itself all copyrights and other rights in such Research, including the survey questionnaire, developer acquisition processes, analysis and data behind the Developer Economics surveys, except as granted to Client in this Agreement.

Table of Contents

About the authors	<u>5</u>
About this report	<u>6</u>
How many software developers are there?	<u>7</u>
Growth of the global developer population	<u>11</u>
Major developer communities	<u>14</u>
Methodology	<u>20</u>

About the authors



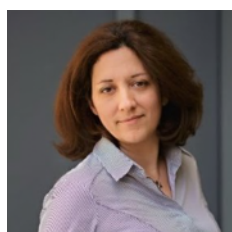
✉ stijn@slashdata.co

🐦 [@stijnschuermans](https://twitter.com/stijnschuermans)

STIJN SHUERMANS

Senior Business Analyst

Stijn leads the SlashData research on developer program benchmarking, developer population sizing, and the Internet of Things. He has authored over 35 reports and research notes. His approach combines data from large-scale developer surveys with strategic insights on business models and industries, including platform economics. Stijn has a Master's degree in engineering and an MBA. He has over 10 years' experience as an engineer, product manager, strategist and business analyst.



✉ christina@slashdata.co

🐦 [@ChristinaVoskog](https://twitter.com/ChristinaVoskog)

CHRISTINA VOSKOGLOU

Director of Research and Operations

Christina is responsible for all SlashData's research products and heads the analyst and operations teams. With more than 18 years of experience in data mining, BI and CRM design, she leads research planning and methodology, survey design, data analysis, insights generation and research commercialisation. Christina is also behind SlashData's outcome-based developer segmentation model and is the leading SlashData researcher in Machine Learning and Data Science.

About this report

In this report, SlashData answers the simple* question: how many software developers are there in the world? We estimate that at the start of 2019 there were just under 19 million active software developers globally, out of which 13M are software professionals. The developer population is currently growing strongly, at a rate of over 20%.

Our estimate is derived independently, using a bottom-up approach firmly rooted in reliable measurement. Any estimate has some degree of uncertainty associated with it, as well as embedded choices and trade-offs, and should be used with an appropriate level of care and precision.

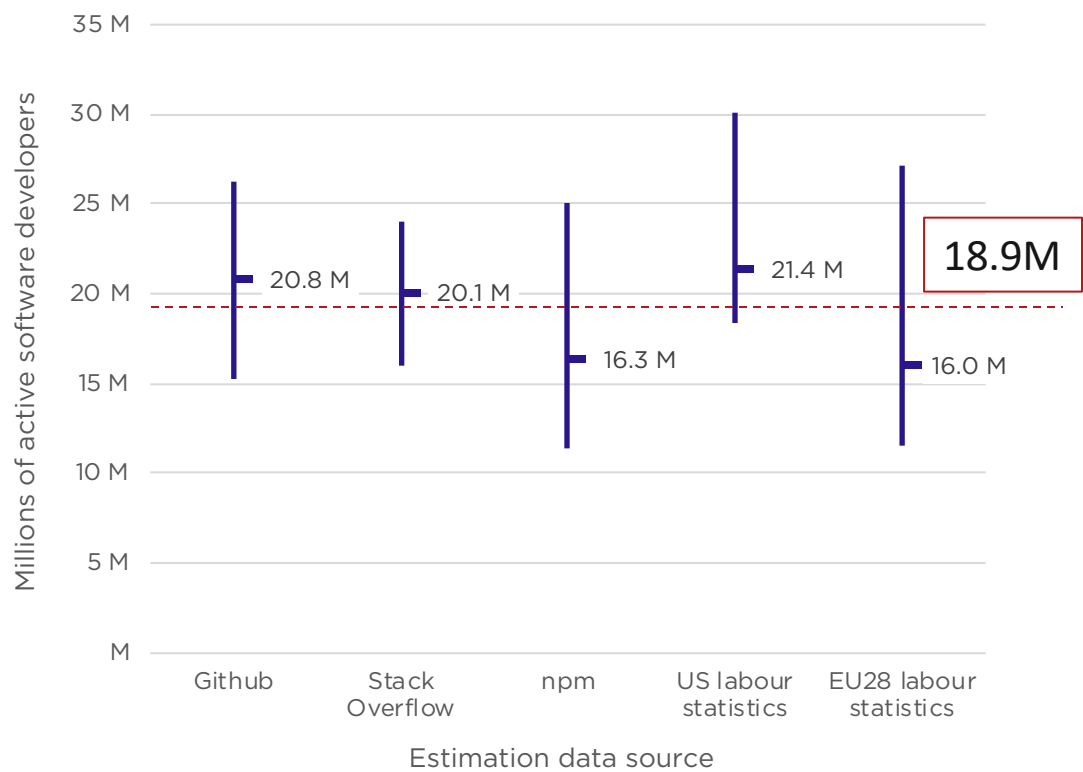
(*) Spoiler alert: it isn't.



How many software developers are there?

SlashData estimates that there are just under 19M active software developers in the world at the start of 2019, out of which 13M are software professionals. We have arrived at this estimate using a bottom-up methodology from five different sources.

Estimated global population of active software developers, Q4 2018



Global developer population report 2019 . <https://sdata.me/GlobalDevPop19> · ©SlashData

We present an independent methodology to estimate the global number of active software developers based on two pillars:

1. Reliably measured numbers of developers or direct indicators of their activity: Github accounts and repos, Stack Overflow accounts, npm accounts, and employment statistics from the USA and the European Union.
2. Our developer survey data, i.e. measured developer behaviour. We have currently completed 16 editions of this large-scale survey and reach over 20,000 developers per edition.

We are of course aware that other estimates of the developer population that circulate are higher than ours: upwards of 20 million, and sometimes as high as 35 or even 60 million developers. We believe that our estimate, while conservative, is strongly backed by evidence of actual developer activity.

Most estimates of developer communities floating around the internet are based on (unique) pageviews, downloads, IP addresses, and so on. All of these are susceptible to a multiplier effect, not in the least due to multi-machine and multi-browser software testing, frequent cleaning of caches and cookies for testing, repeat downloads of developer tools, and development automation (e.g. build servers). Sometimes, it's not clear whether estimates have any basis at all. The numbers that we report are exclusively based on what we consider to be direct indicators of human developer activity.

The most well-researched and oft-cited third party developer population estimates out there are based on labour statistics and assumptions about populations. They measure or estimate proxy variables such as the percentage of the IT workforce that code. These parameters are measured in some countries and then extrapolated to most other geographies. We avoid to the maximum extent possible making assumptions about similarities between geographies and other subsets of the developer population, as our surveys consistently show substantial differences across regions and developer segments.

A full breakdown of our [methodology](#) is available to our report subscribers, as is a discussion on the trade-offs we made in creating these estimates.

Who is considered a developer?

“Developers” are on a continuous spectrum of involvement with coding - from the most hardcore programming experts to six-year-olds making a toy Code-a-Pillar™ move around the room. Any threshold is to some extent arbitrary. This makes the definition of a developer a fundamental source of estimation uncertainty. Even occasional coders themselves may not be very clear or consistent on whether they consider themselves to be developers.

The first thing we look for is whether a developer is **active**, i.e. whether there is recent evidence of coding. People may have written code at some point, but then moved on to other priorities in their lives. Dormant and ex-developers should not be counted.

Secondly, in order to get a meaningful count of developers, we assume that developers must be involved in **substantial coding projects**. This is of course an ambiguous term. It likely excludes people in other technical jobs who occasionally write a small automation script, for example, but likely includes hobby and side projects in which people invest many hours of their time.

We do count developers who code purely as a **hobby** or who are still studying the field, without being professionally involved in any software area. Our survey data over the years is fairly consistent on this, with pure hobbyists/students representing just under a third of developers. We estimate that there are 6M hobby developers and students at the end of Q4 2018, in addition to the 12.9M professional software developers.

Finally, we are counting developers **globally**. This presents us with a problem when the underlying data is itself heavily regionally skewed. This is by definition the case for labour statistics, but also for the count of Stack Overflow accounts, for example. This service is strongest in Europe and North America, but much less frequently used in other parts of the world. We rely on the weighted regional distribution from our surveys to get an accurate global representation of the developer population.

18.9M

ACTIVE SOFTWARE DEVELOPERS GLOBALLY

12.9M

PROFESSIONAL SOFTWARE DEVELOPERS

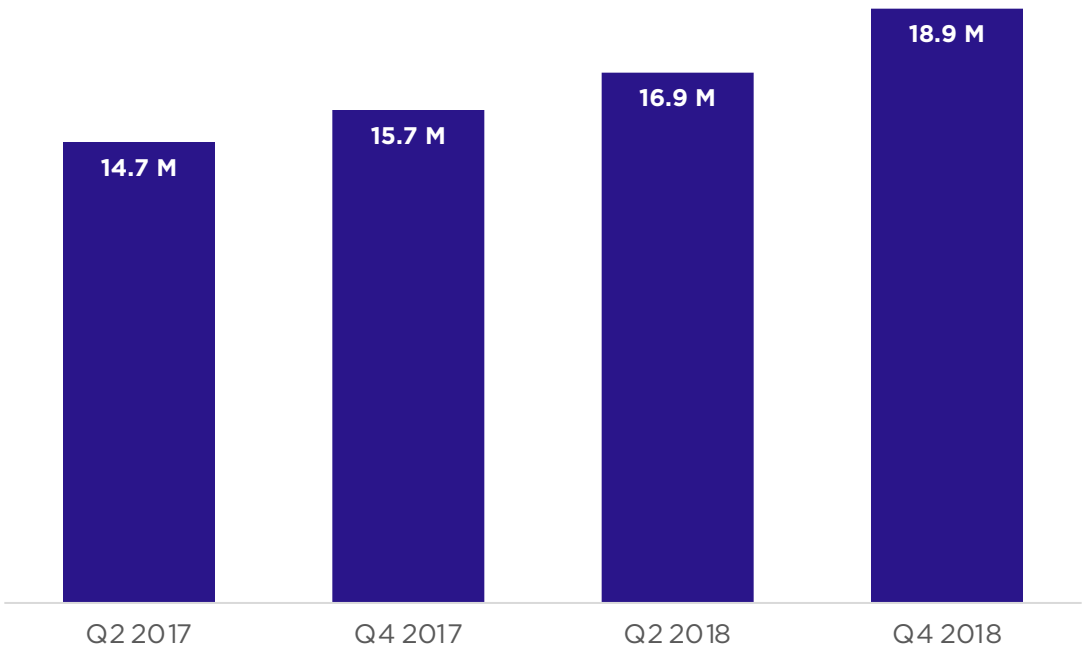


Growth of the global developer population

We have used our current methodology to produce estimates of the global developer population for the past four half-year periods. Each estimate was produced independently of the others. This reveals an increase in the developer population of 4.2M developers since mid 2017, or an annual growth that hovers around 20%. This growth rate seems to be accelerating, although it is based on just a few periods.

Growth of the global developer population

Millions of active software developers



Global developer population report 2019 . <https://sdata.me/GlobalDevPop19> · ©SlashData

Let's provide some context to this growth estimate. Well over half of the world's population is now using the internet, more than double the penetration of a decade ago. The International Telecommunications Union estimates that at the end of 2018, 51.2% of the global population, or 3.9 billion people, were using the Internet¹. In 2008, only 1.5 billion people had internet access. While the number of internet users in the developed and the developing world were similar in 2008, nowadays there are almost three times as many internet users in the developing world. Much of that increase was driven by the smartphone revolution. The number of active mobile-broadband subscriptions has increased more than 10x, according to the ITU.

21%

GROWTH IN 2018

¹ https://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2018/ITU_Key_2005-2018_ICT_data_with%20LDCs_rev27Nov2018.xls

A lot of people now have access to the world's information, which they didn't have before. This includes the educational resources to learn how to code. Becoming a programmer is now a realistic career path for millions in the developing world in particular. There will also be no shortage of local needs and niches to cater to. In our data, per-country internet penetration and the number of developers relative to the population are indeed correlated.

At the same time, the reach of software in industrial and consumer products is ever increasing. Smartphone technology and its offshoots into the Internet of Things have made computing ubiquitous, pushing it far beyond the boundaries of PCs and servers. Cloud technology has made access to large-scale computing resources not just easy, but incredibly affordable.

It stands to reason that this is a period in which we will see a strong increase in the global developer population, as indeed we are observing from our estimates.

If we extrapolate the current growth rate outwards, we can expect to see at least 21M developers by the end of 2019 and possibly upwards of 23M.

Looking further out, making assumptions about population growth, internet penetration growth, and a percentage of 'developers per capita' that matches our current data, we can expect that the developer population will more than double in the next decade, to about 45M in 2030. The implied annual growth rate would be 8.2%, significantly lower than the growth we're currently seeing.

45M

DEVELOPERS GLOBALLY IN 2030

“

**The developer population
will more than double in
the next decade**

3

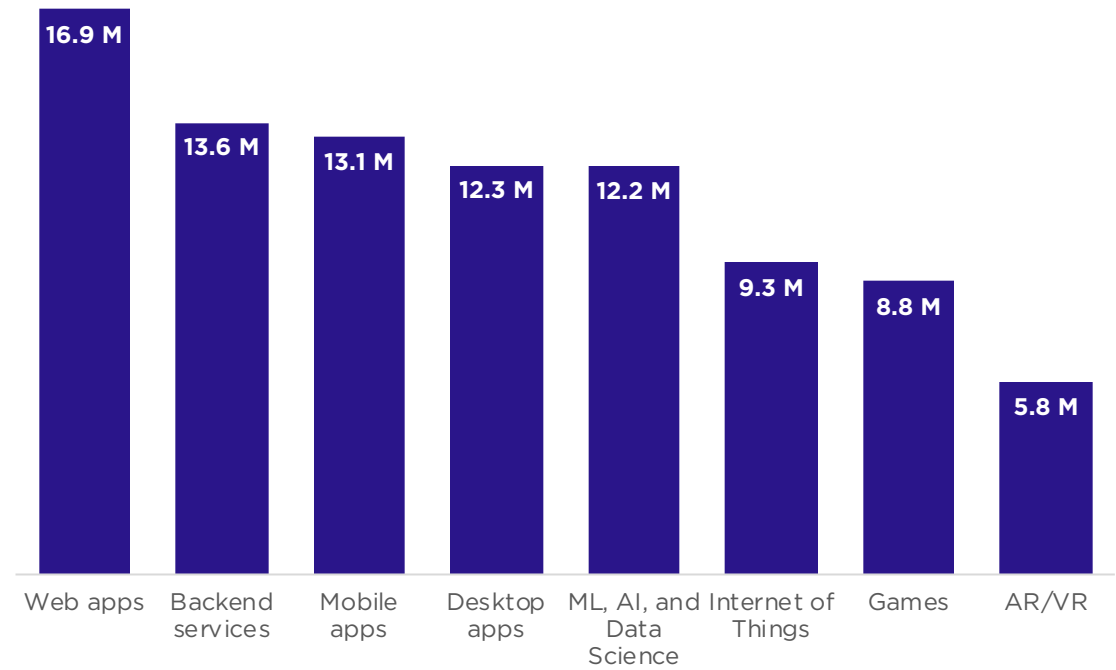
Major developer communities

The population of software developers is of course not equally distributed across the world, nor is it one homogeneous community. Our longstanding, large-scale, global surveys allow us to reliably break down the global number of 18.9M developers in a myriad of ways. For example, we estimate that 4M developers are located in Western Europe & Israel. For the community edition of this report, we'll focus on software sectors and programming language communities.

Software sectors

Software sectors and their communities

Millions of active software developers, Q4 2018 n = 19,011



Global developer population report 2019 · <https://sdata.me/GlobalDevPop19> · ©SlashData

One of the most common questions we get about developer populations, is to size specific communities, e.g. cloud developers. With this section, we're happy to oblige.

The first thing to note with these sector estimates, is that they sum up to much more than the global developer population. Indeed, only a small minority of developers are involved in just one sector.

Developers may be involved in multiple sectors professionally or, most commonly, in some sectors professionally and in a few more as hobbyists, working on side projects, or as students. On average, developers are involved in close to five sectors concurrently.

The current mainstream sector is the web: close to 17M developers are creating web apps; 13.6M are developing backend services, of which a majority use public cloud technology. Other mature sectors include mobile and desktop apps, with 13.1 and 12.3M developers respectively. Desktop is the slowest-growing software sector, but it still sees double-digit YoY growth.

In the past two years, we've seen a sharp increase in the number of developers involved in machine learning, artificial intelligence, or data science. This is clearly the technology of the moment; the technology that many developers see as a worthwhile investment in their future skills. At the start of 2019, 12.2M developers were involved in these fields.

The Internet of Things (9.3M) and AR/VR (5.8M) are emerging sectors. In particular the latter is growing fast. Games is a somewhat niche sector, with 8.8M developers despite a long history. Many game developers label themselves as hobbyists in this field, although often they still choose to publish their work.

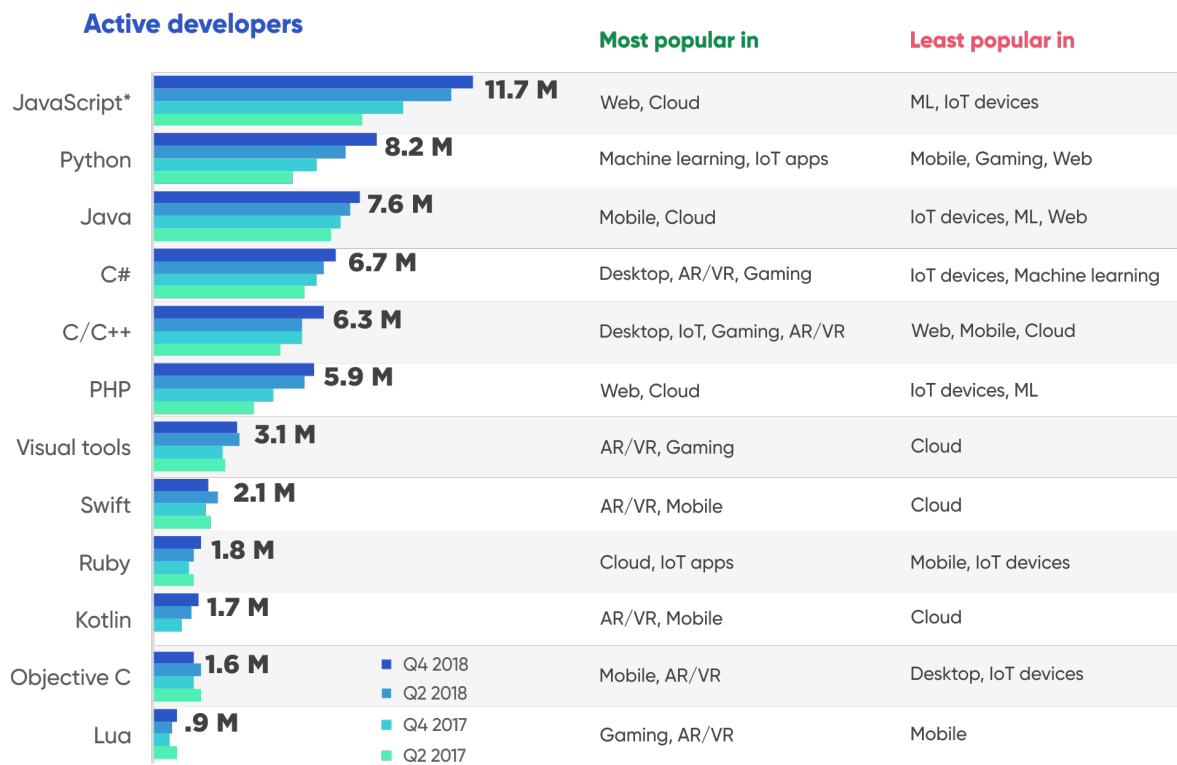
12.2M

AI/ML DEVELOPERS

Programming languages

Java, C# and C/C++ grow slower than the developer population

Number of active software developers globally, in millions, Q4 2018 (n: 11,519)



(*) JavaScript includes CoffeeScript, TypeScript

The 'least popular' column only includes sectors for which we have data on the language in question.

Global developer population report 2019 . <https://sdata.me/GlobalDevPop19> · ©SlashData



The choice of programming language matters deeply to developers because they want to keep their skills up to date and marketable. Languages are a beloved subject of debate and the kernels of some of the strongest developer communities. They matter to toolmakers too, as they want to make sure they provide the most useful SDKs.

It can be hard to assess how widely used a programming language is. The indices available from players like Tiobe, Redmonk, Stack Overflow's yearly survey, or Github's Octoverse are great, but mostly offer only relative comparisons between languages, providing no sense of the absolute size of each community. They may also be biased geographically, or skewed towards certain fields of software development, or open source developers.

The estimates we present here look at active software developers using each programming language, across the globe and across all kinds of programmers. In our survey, we consistently ask developers about their use of programming languages across nine areas of development², giving us rich and reliable information about who uses each language and in which context.

JavaScript is and remains the queen of programming languages. Its community of 11.7M developers is the largest of all languages. In 2018, 2.5M developers joined the community: the highest growth in absolute numbers and more than the entire population of Swift, Ruby, or Kotlin developers, amongst others. New developers see it as an attractive entry-level language, but also existing developers are adding it to their skillset. Even in software sectors where Javascript is least popular like machine learning or on-device code in IoT, over a quarter of developers use it for their projects.

Python has reached 8.2M active developers and has now surpassed Java in terms of popularity. It is the second-fastest growing language community in absolute terms with 2.2M net new Python developers in 2018. The rise of machine learning is a clear factor in its popularity. A whopping 69% of machine learning developers and data scientists now use Python (compared to 24% of them using R).

Java (7.6M active developers), C# (6.7M), and C/C++ (6.3M) are fairly close together in terms of community size and certainly well established languages. However, all three are now growing at a slower rate than the general developer population. While they are not exactly stagnating, they are no longer the first languages that (new) developers look to.

²We have programming language information for each of the following fields: web, cloud, mobile, desktop, IoT applications, IoT device-side code, game development, AR/VR, and machine learning & data science. In this report, we look at broadly used languages, present in 6 or more of these areas, counting developers who use each language in at least one area. Developers don't have to prioritise a programming language for it to count; it may be that they only use a language occasionally.

Java is very popular in the mobile ecosystem and its offshoots (Android), but not for IoT devices. C# is a core part of the Microsoft ecosystem. Throughout our research, we see a consistent correlation between the use of C# and the use of Microsoft developer products. It's no surprise to see desktop and AR/VR (Hololens) as areas where C# is popular. C/C++ is a core language family for game engines and in IoT, where performance and low-level access matter (AR/VR exists on the boundary between games and IoT).

PHP is now the second most popular language for web development and the fifth most popular language overall, with 5.9M developers. Like Python, it's growing significantly faster than the overall developer population, having added 32% more developers to its ranks in 2018. Despite having (arguably) a somewhat bad reputation, the fact that PHP is easy to learn and widely deployed still propels it forward as a major language for the modern Internet.

The fastest growing language community in percentage terms is Kotlin. It grew by 58% in 2018 from 1.1M to 1.7M developers. Since Google has made Kotlin a first-class language for Android development, we can expect this growth to continue, in a similar way to how Swift overtook Objective-C for iOS development.

Other niche languages don't seem to be adding many developers, if any. Swift and Objective-C are important languages to the Apple community, but are stable in terms of the number of developers that use them. Ruby and Lua are not growing their communities quickly either.

Older and more popular programming languages have vocal critics, while new, exciting languages often have enthusiastic supporters. This data would suggest that it's not easy for new languages to grow beyond their niche and become the next big thing. What does this mean for the future of these languages and others like Go or Scala? We will certainly keep tracking this evolution and plan to keep you informed.

4 Methodology

All four methods for estimating the global developer population follow the same general approach. We match a measurement of developer activity from a public source with the corresponding group in our Developer Economics survey data. We then use our survey data to extrapolate this estimate to the full developer population. A detailed discussion of our sizing methodology is available to our report subscribers.

Developer Economics survey data

Developer Economics 16th edition reached 19,000+ respondents from 165 countries around the world. As such, the Developer Economics series continues to be the most global independent research on mobile, desktop, IoT, cloud, web, game, AR/VR and machine learning developers and data scientists combined ever conducted. The report is based on a large-scale online developer survey designed, produced and carried out by SlashData over a period of eight weeks between November 2018 and February 2019.

Respondents to the online survey came from 165 countries, including major app, machine learning and IoT development hotspots such as the US, China, India, Israel, UK and Russia and stretching all the way to Kenya, Brazil and Jordan. The geographic reach of this survey is truly reflective of the global scale of the developer economy. The online survey was translated into eight languages in addition to English (simplified Chinese, traditional Chinese, Spanish, Portuguese, Vietnamese, Russian, Japanese, Korean) and promoted by 80 leading community and media partners within the software development industry.

To eliminate the effect of regional sampling biases, we weighted the regional distribution across eight regions by a factor that was determined by the regional distribution and growth trends identified in our Developer Economy research. Each of the separate branches: mobile, desktop, IoT, cloud, web, games, augmented and virtual reality, and data science and machine learning were weighted independently and then combined.

To minimise other important sampling biases across our outreach channels, we weighted the responses to derive a representative distribution for platforms, segments and types of IoT project. Using ensemble modeling methods, we derived a weighted distribution based on data from independent, representative channels, excluding the channels of our research partners to eliminate sampling bias due to respondents recruited via these channels. Again, this was performed separately for each of mobile, IoT, desktop, cloud, web, games, augmented and virtual reality, and data science and machine learning.

For more information on our methodology please visit:
<https://www.slashdata.co/methodology>.



DEVELOPER ECONOMICS SURVEY

LIVE NOW

ARE YOU A DEVELOPER?

This includes professionals, hobbyists and students working across mobile, web, desktop, cloud, IoT, AR/VR, games, machine learning & data science.

Is that a yes? Then this survey is definitely for you!

WHAT YOU GET BY TAKING PART IN THE SURVEY

- You could win one of \$12,000+ worth of prizes including: Microsoft Surface Pro 6, Samsung Chromebook 3, JetBrains IDE, Oculus Rift S plus lots of dev swag, accessories, vouchers and more. Visit developereconomics.net to see all prizes.
- Through our referral program, refer other developers to take the survey and win up to \$1,000 in cash.
- Compare your skills to the global average. We'll send you graphs to see in which areas you need to work more and in which you are a coding ninja!
- Learn about new technologies and tools that you might not be aware of.

This is your chance to be amongst those who shape the future.

**WE DON'T JUST SAY
"SHAPE THE FUTURE",
WE MEAN IT**

For each completed response to the survey, /Data will donate USD \$0.1 to the Raspberry Pi Foundation. Our goal is to reach \$2,000+ to support the developers of tomorrow and help them access tools and learning courses.

NO EXCUSES

TAKE THE SURVEY

We help the world understand
developers
– and developers understand
the world



Global developer population report 2019 . <https://sdata.me/GlobalDevPop19> · ©SlashData

