



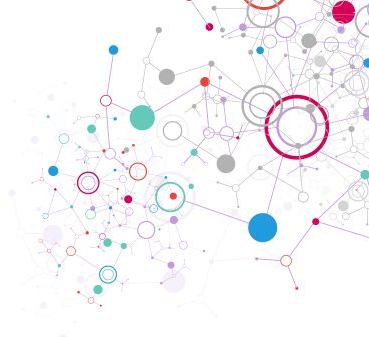
Collectively working towards OSS sustainability

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About me



Market Researcher
Consultant
Data Analyst
Program Manager



CHA^{OSS}

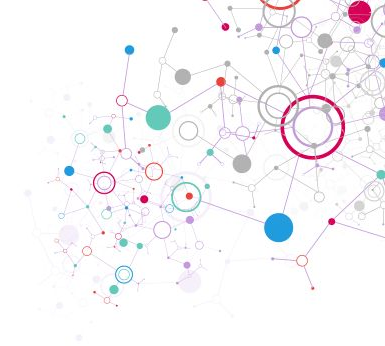
*Community Health Analytics
Open Source Software*

CHA^{OSS}

<https://chaoss.community/>
<https://github.com/chaoss>



What do we mean by OSS sustainability?



“Able to be maintained” - Oxford Language dictionary

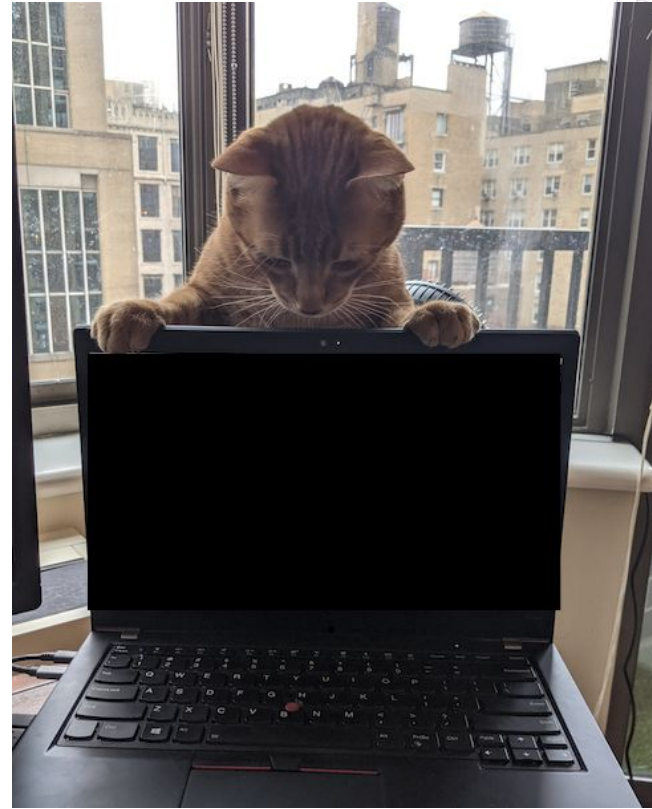
“...ability to maintain or support a process continuously over time...prevent the depletion of natural or physical resources, so that they will remain available for the long term”

- investopedia.com/terms/s/sustainability

“Permanence -> Resilient, Adaptable” - OSS sustainability forum 2023



How sustainable is open source software today?



Sustainable... for whom?

Creators: Is the workload manageable?

- Will work continue if a maintainer steps away?

Consumers: How long is a version 'supported'?

- How long can users rely on this software?



Open source usage is pervasive...but contribution is not

96% of the codebases reviewed for their annual report contained open source software (Synopsys/Black Duck report 2024)

...But how users many contribute back?



Many popular OSS packages are supported by only a handful of contributors



“Reviewing 49 of the top 50 non-npm projects from our lists, for commits in the year 2021, it was found that **23% of projects had one developer** accounting for more than **80% of the lines of code (LOC)** added.”

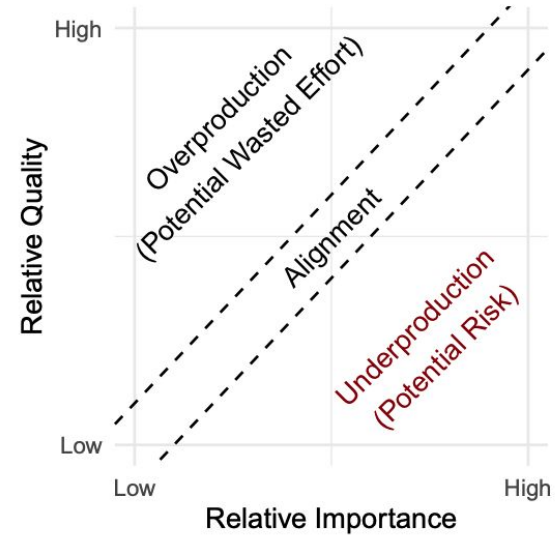
“At a higher level, it was found that 136 developers were responsible for more than 80% of the LOC added to these 50 FOSS projects”

Source: F. Nagle, J. Dana, J. Hoffman, S. Randazzo, Y. Zhou, “Census II of Free and Open Source Software — Application Libraries”

www.linuxfoundation.org/hubfs/Research%20Reports/lfr_harvard_censusII_mar2022_042824b.pdf

How many projects are 'underproduced'?

“ ‘underproduction’ ... occurs when the **supply of software engineering labor** becomes out of alignment with the **demand of people who rely on the software produced**”

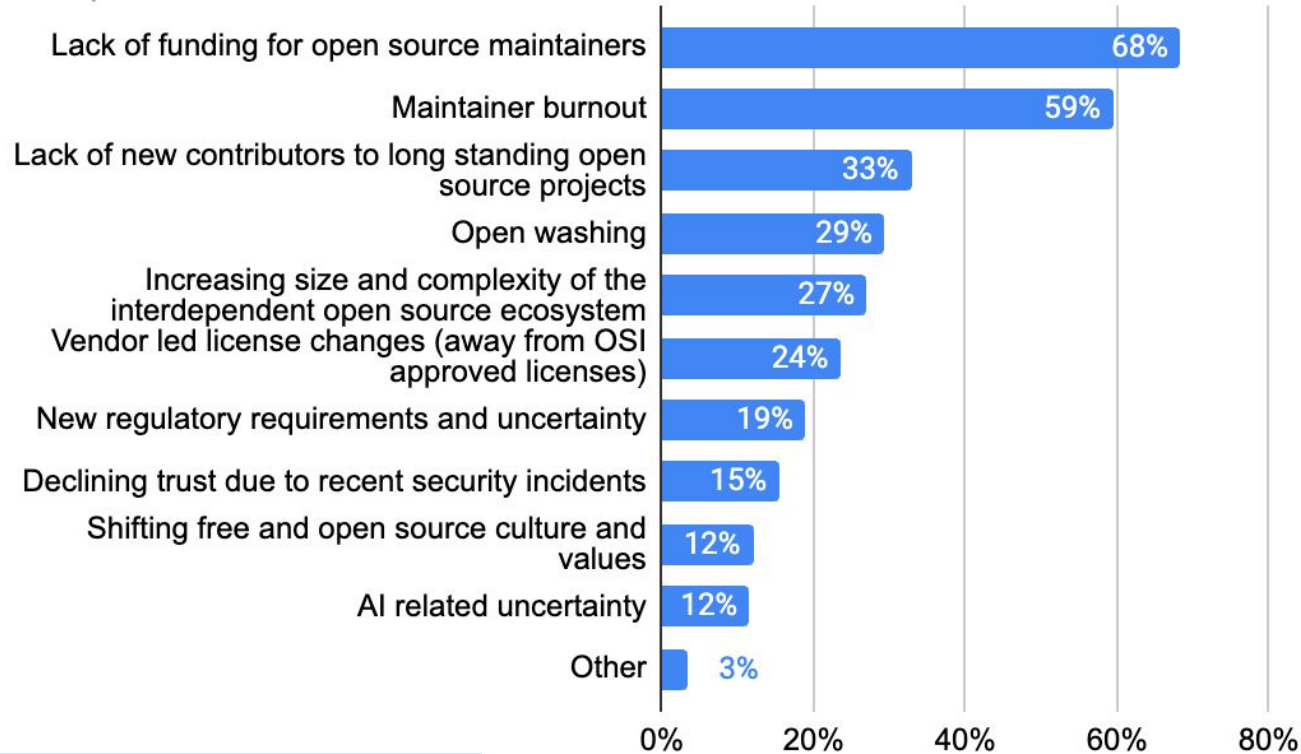


Source: K. Champion, B Hill, “Underproduction: An Approach for Measuring Risk in Open Source Software”, 2021 IEEE International Conference on Software Analysis, Evolution and Reengineering (SANER); doi.org/10.48550/arXiv.2103.00352

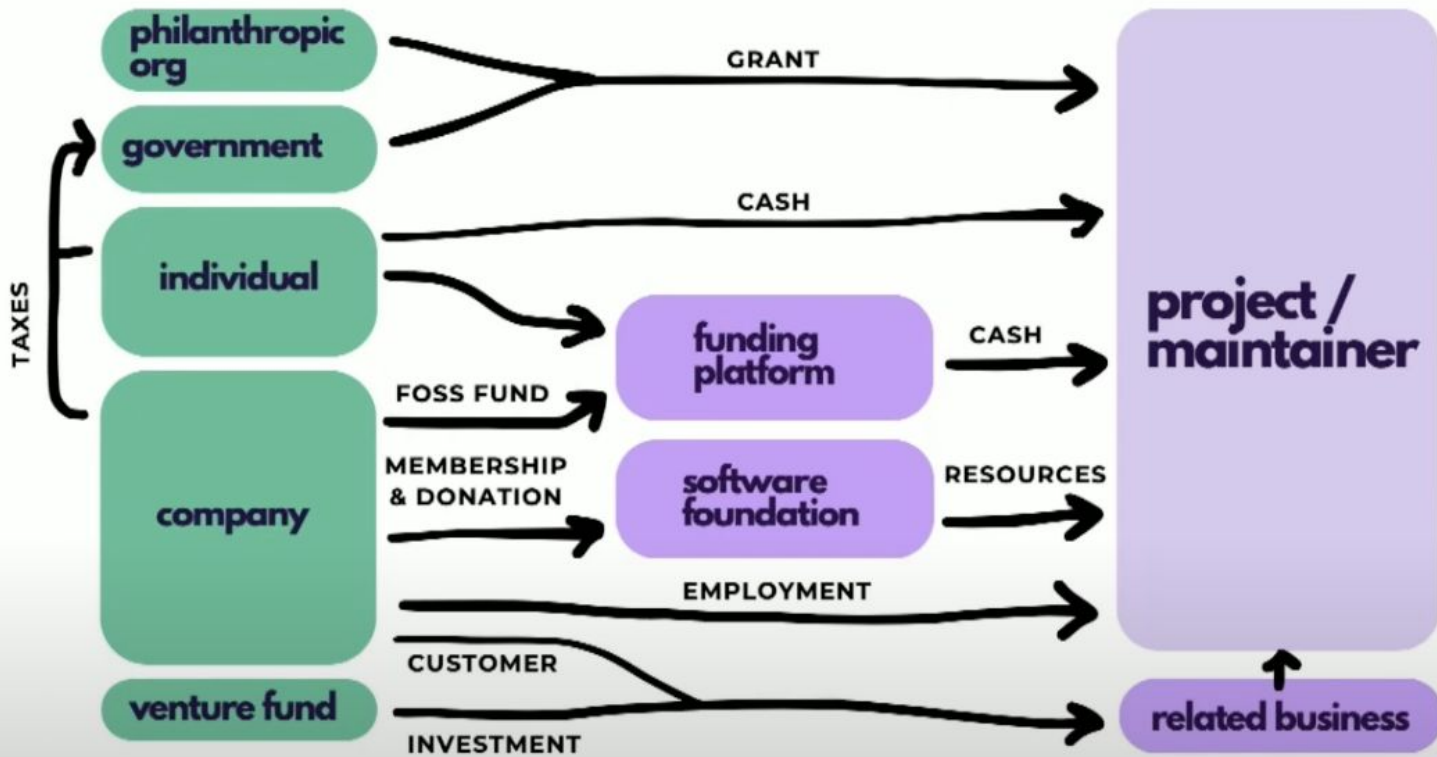
How can we better support our human infrastructure?

In your opinion, what are the biggest challenges facing open source today? (Select up to 3)

Respondent count: 259

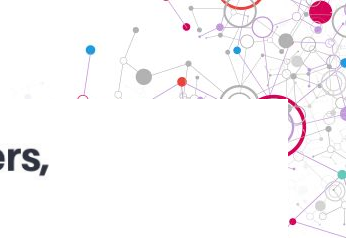


money flow to open source maintainers



KARA SOWLES @FEYNUDIBRANCH

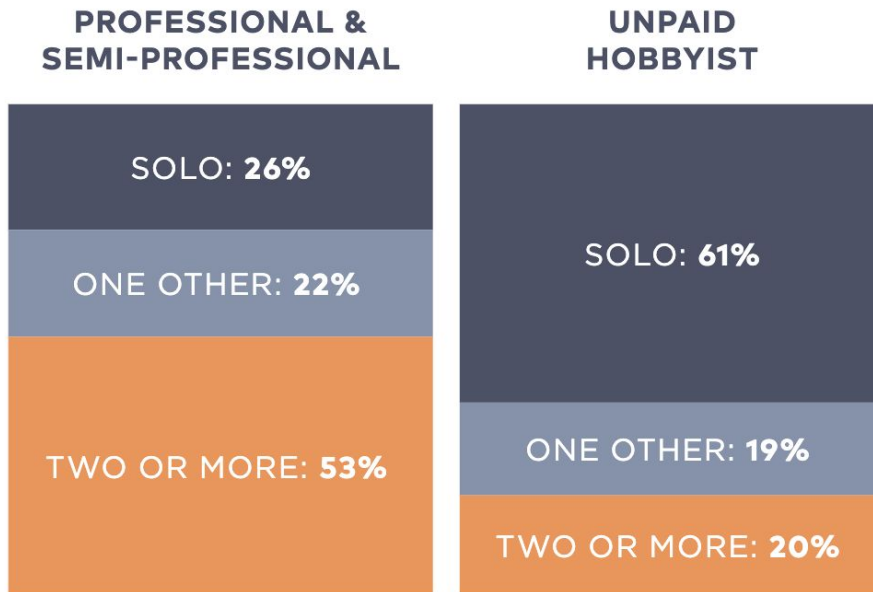
Source: K. Sowles, The State Of Open Source Software Funding, Open Source Summit NA 2024 <https://www.youtube.com/watch?v=8Yr2gGsgRsY>



Paid maintainers are more likely to have co-maintainers, unpaid maintainers are more likely to be flying solo

How many people maintain the project or projects you maintain?

60% of maintainers are not paid for their work



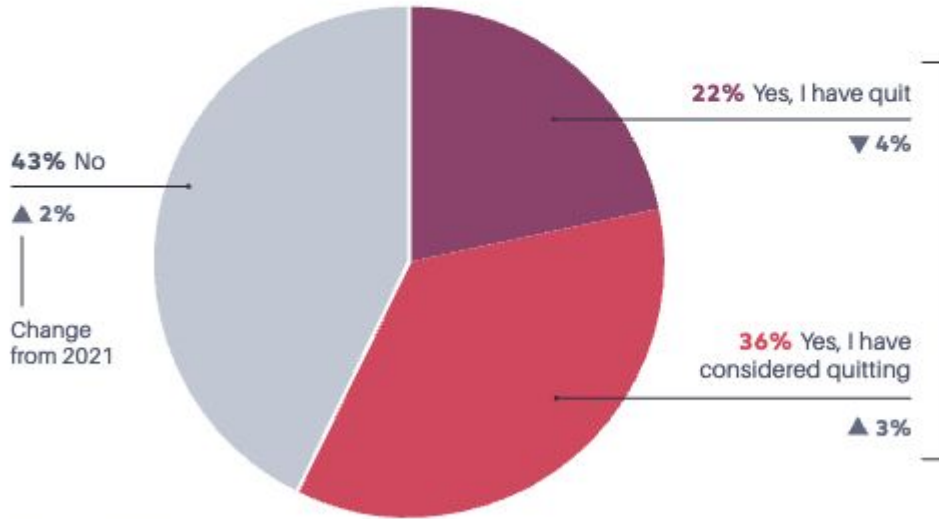
In 2023, ~86% of public repositories on GitHub only have 1 contributor

(source: GHarchive.org)

Professional maintainers, n=42; Semi-professional maintainers, n=91; Unpaid hobbyist maintainers, n=227. Totals do not equal 100% because of rounding.

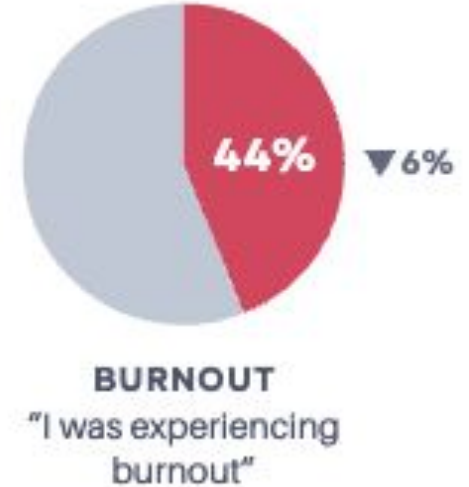
A majority of maintainers have at least considered quitting one of their projects

Have you quit or considered quitting maintaining a project?

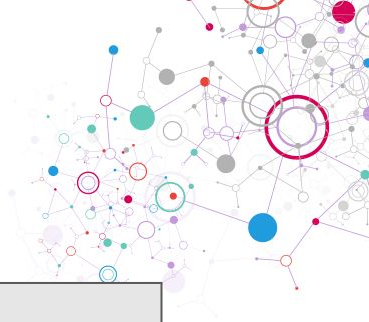


2023: n=349; 2021: n=265

“What are the key reasons you quit or considered quitting as maintainer of the project(s)?”



Can metrics proactively signal collective burnout?

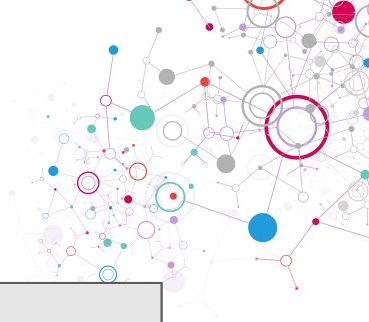


Who's doing how much?	What's slowing down? What's building up?
How easy is it to grow new contributors and maintainers?	How do people feel about their OSS work?

Source: S. Vargas "Combat Maintainer Burnout with Proactive Metrics", KubeCon EU 2023; www.youtube.com/watch?v=C2Zn2tqsU6I



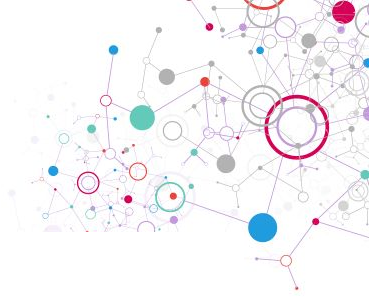
Can metrics proactively signal collective burnout?



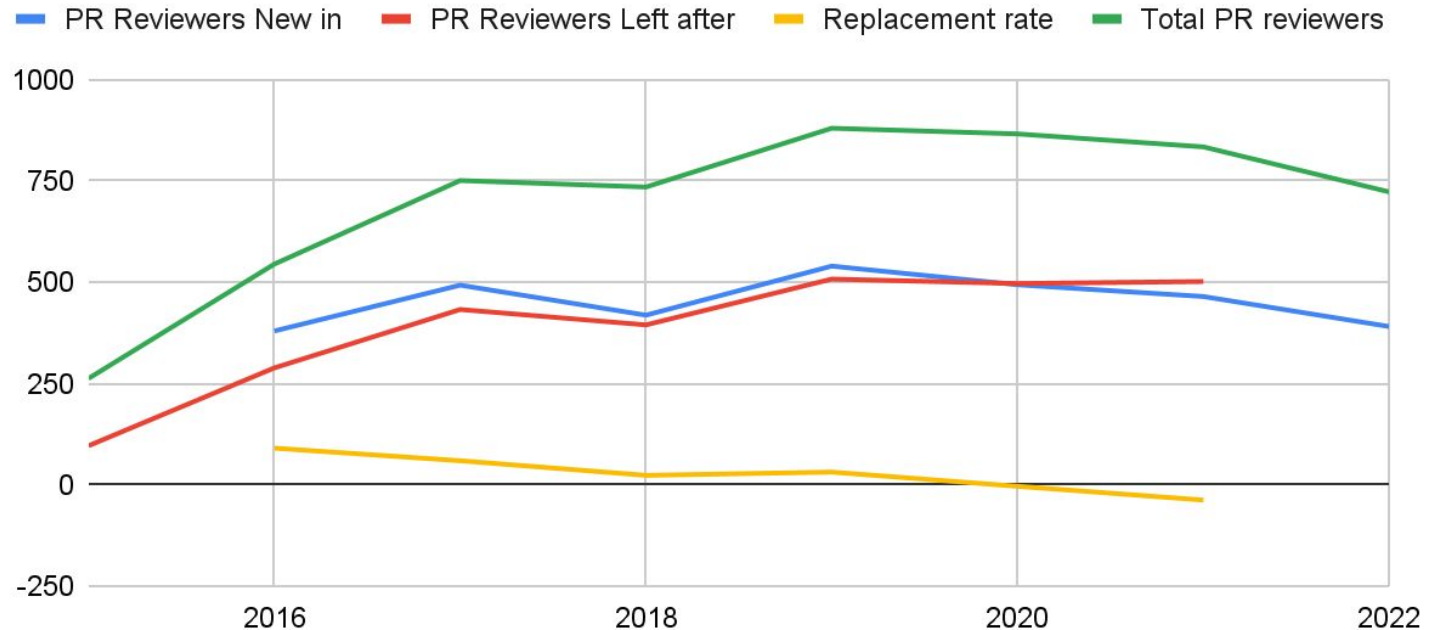
<i>% of work done by top X</i>	<i>Time to respond; time to close; backlog count</i>
<i>Attrition of top X; replacement of top contributors</i>	<i>Survey; interviews</i>



Overall attrition and replacement of reviewers in Kubernetes



Kubernetes/Kubernetes: All time PR reviewer Attrition



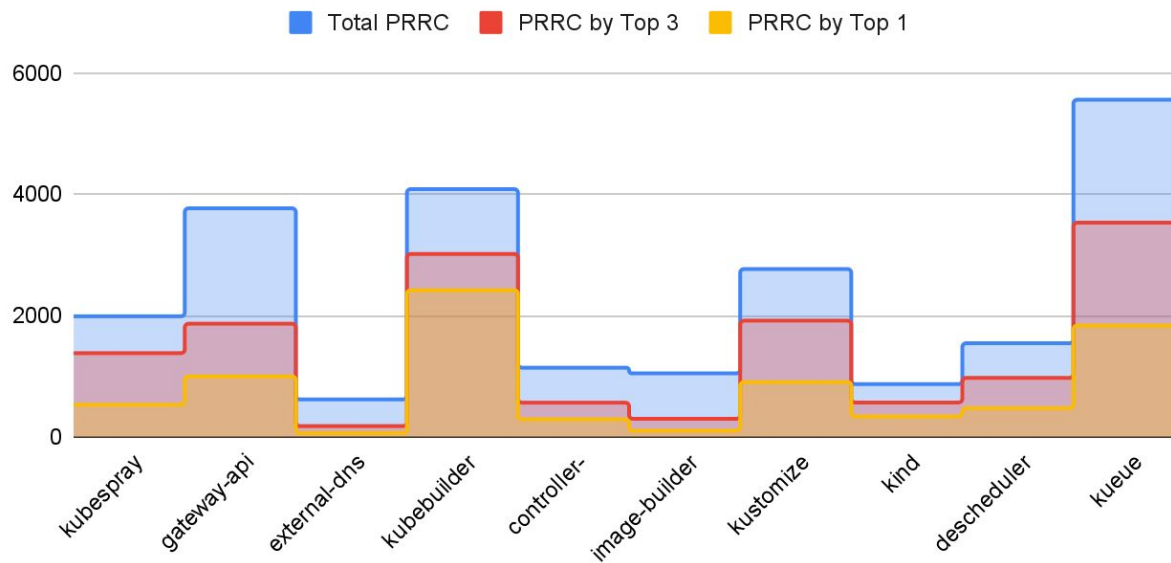
Source: Source: gharchive.org via Google BigQuery



Work distribution in Kubernetes SIGs



2022: K8s SIG PullRequestReviews + PullRequestReviewComment



Total PRRC actors

86	74	72	69	64	51	49	41	30	28
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Other ways to detect burnout?



“Our models show that there is a sizable effect when **developers comment much more than their average:** the negative sentiment in their comments increases, suggesting an increased level of stress.”

TABLE I
SENTIMENT DISTRIBUTION/COMMENT TYPE (844,366 ISSUE DISCUSSION; 576,578 PR DISCUSSION; 318,189 PR CR; 38,363 COMMIT CR).

Comment Type	% Pos	% Neg	% Neu
Discussion on Issues	24.0	11.5	64.5
Discussion on PRs	32.5	10.0	57.6
CR on PRs	15.4	9.5	75.1
CR on Non-PR Commits	20.3	11.3	68.4
Total	25.2	10.6	64.2

Source: F. Sarker, B. Vasilescu, K. Blincoe, V. Filkov “Socio-Technical Work-Rate Increase Associates With Changes in Work Patterns in Online Projects” ICSE '19, Pages 936 - 947; <https://doi.org/10.1109/ICSE.2019.00099>

How to recognize burnout in yourself and others



Suggestions from members of the community:

- **Disagreeable, low patience:** “they got angry and unresponsive, actions were in conflict with the Code of Conduct”
 - **“Notice when your emotions are taking over”**
- **Too available:** “Always on, always responsive”
- **Waning interest:** “The work became boring”



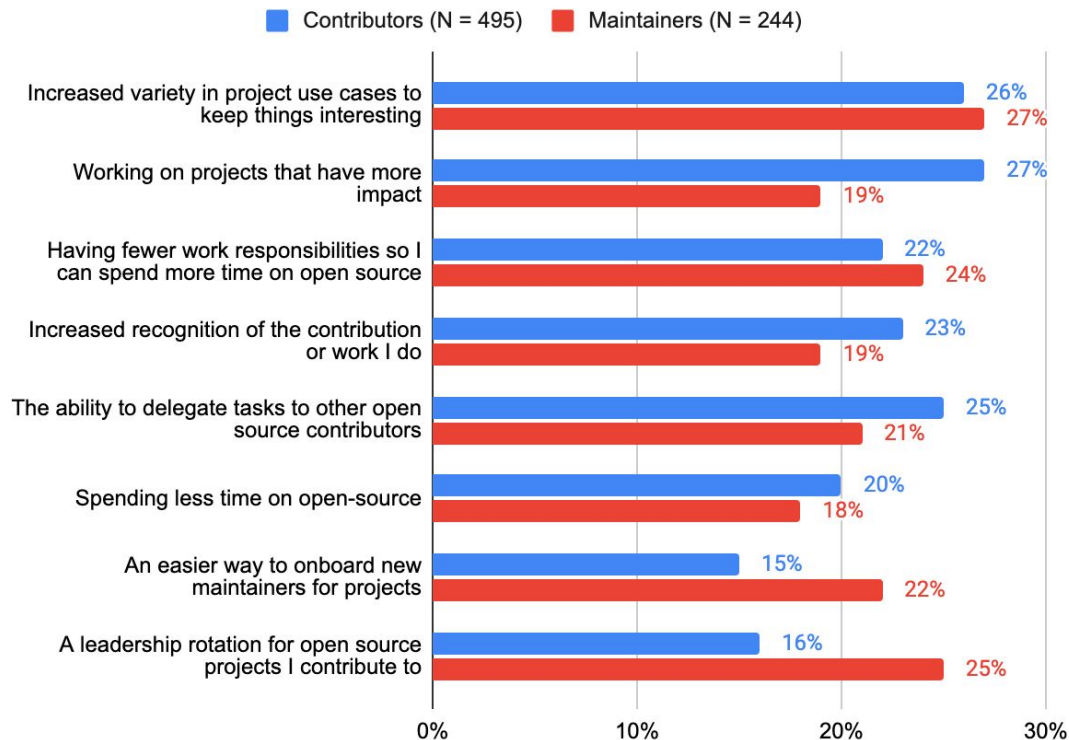
Source: Select quotes from a workshop on burnout hosted by CHAOSS at GitHub Maintainer Month 2022



How can we reduce burnout?

- **Increase variety** - Change it up!
- **Delegate tasks** to allow for breaks
- **Define an onramp path** to contributors and maintainers
- **Institute leadership rotation** so no one feels stuck

From the following list, what are the top two things that would reduce your level of burnout?



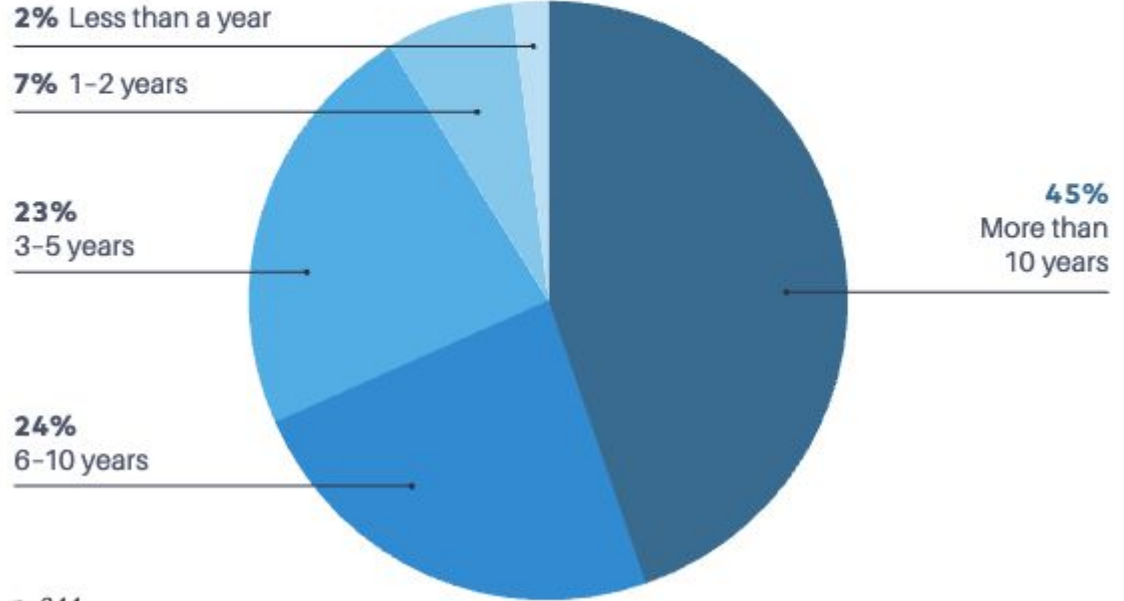
Base: International OSS developers, contributors, maintainers and students
Source: A study commissioned by Google in Q2 2022



What if
there's no
one else?

Almost half of maintainers have been doing the work for more than 10 years

How long have you been an open source maintainer?



n=344



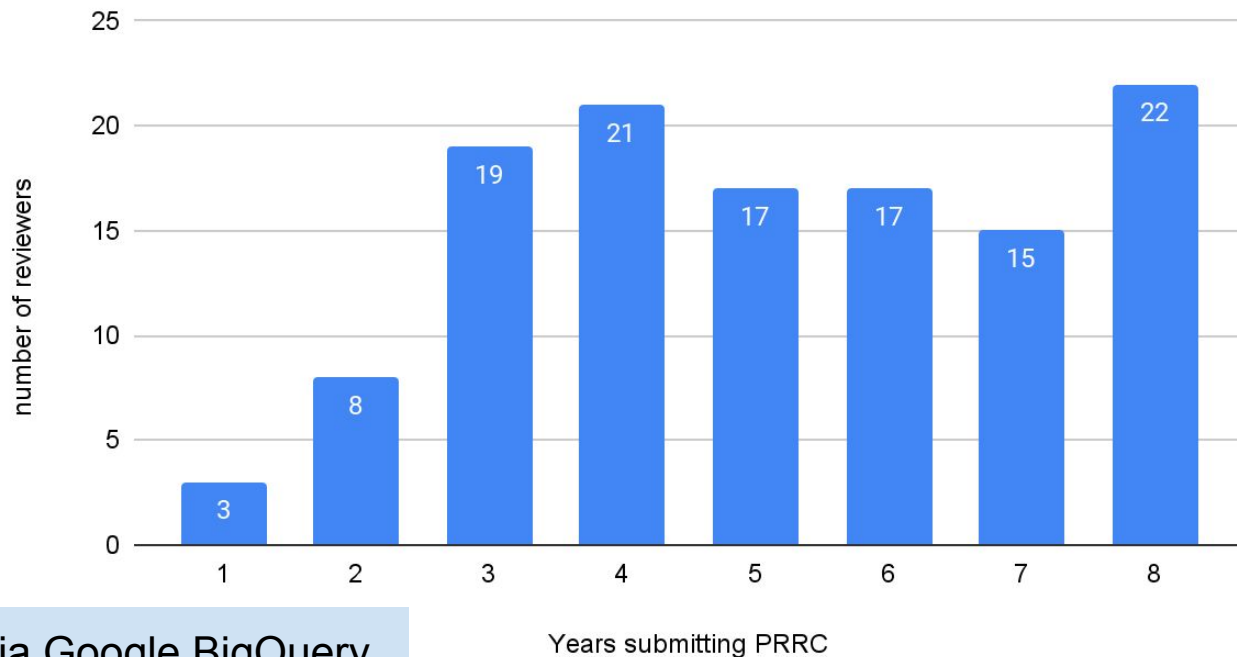
Large communities have the same problem



E. Fox, "Gardens and
Glaciers: Saving Knowledge
Through Succession"
KubeCon EMEA 2023

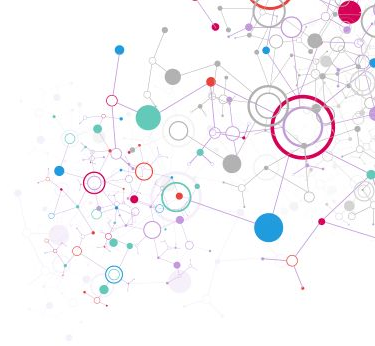
Note: there were
122 individuals who
ranked in the top 35
by PRRC from
2015-2022

Kubernetes/Kubernetes: Tenure of Top 35 reviewers



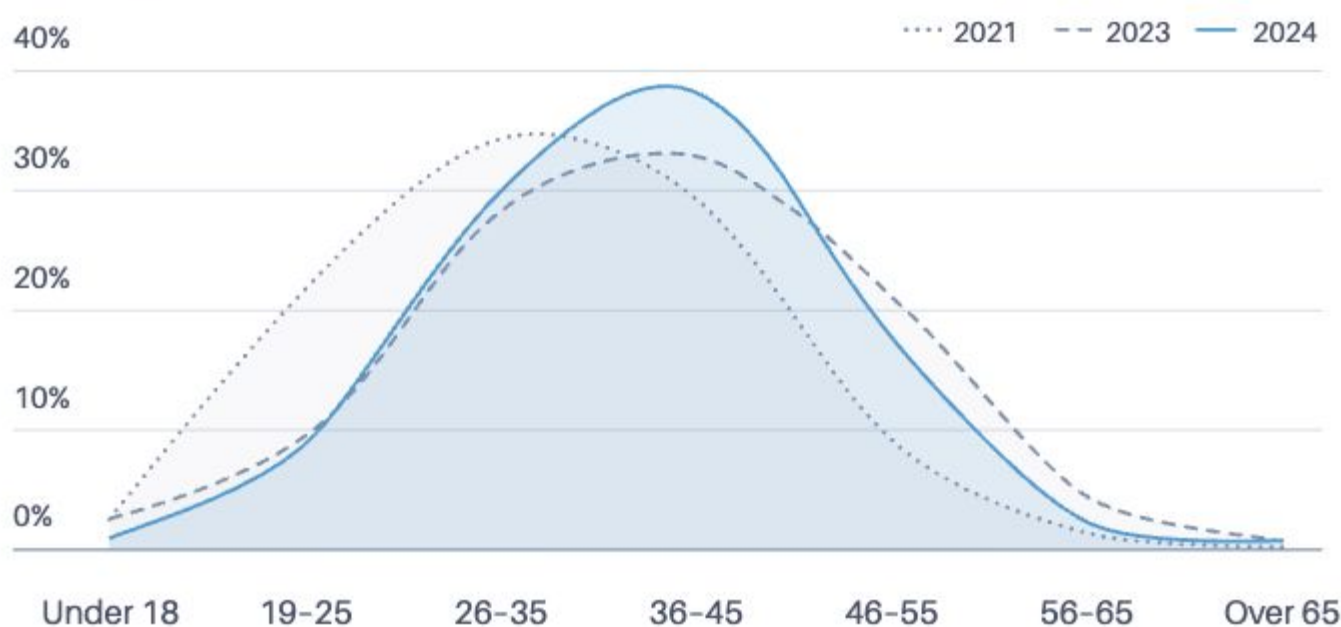
Source: Source: gharchive.org via Google BigQuery

When do maintainers retire?



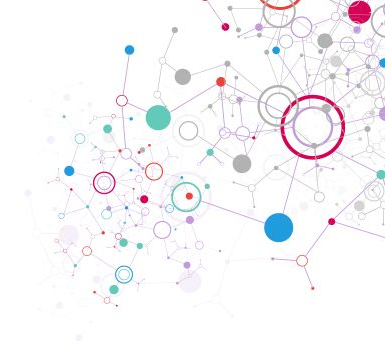
The open source maintainer community is getting grayer

How old are you?



n=344 (2024); n=259 (2023); n=322 (2021)

Source: explore.tidelift.com/2024-tidelift-survey



So what if we recruit
more contributors and
maintainers?

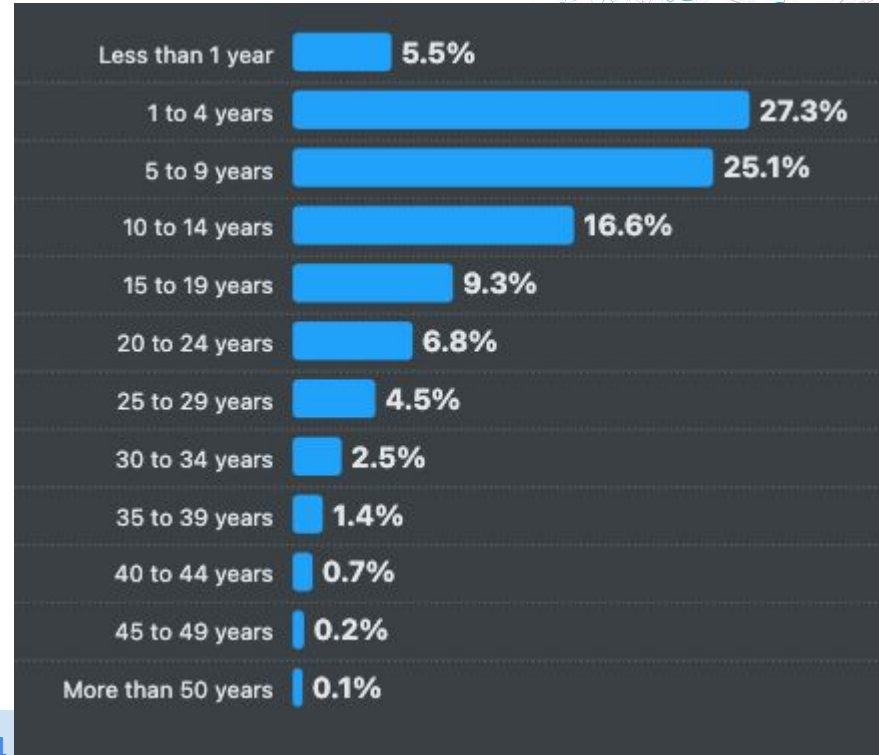
Resource: Contributor Growth Strategies -
Dawn Foster, Oct 2023
www.youtube.com/watch?v=xRCFHhL1lgE

How many users contribute back?

28M global software devs (Statista 2023)

20M accounts on GitHub (Octoverse 2023)

25% of respondents in the stackoverflow survey “contribute to open source projects” outside of work (N = 54,466)

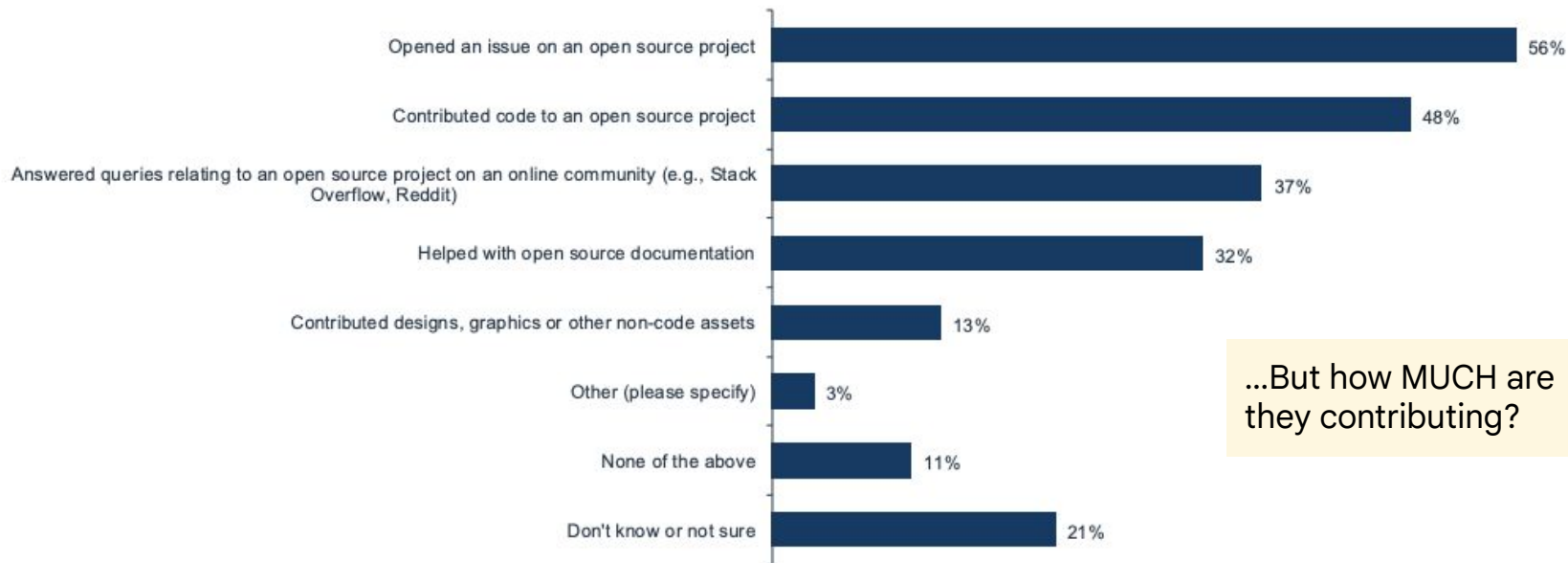


Source: 2024 StackOverflow Survey, survey.stackoverflow.co/2024
[statista.com/statistics/627312/worldwide-developer-population/](https://www.statista.com/statistics/627312/worldwide-developer-population/)
github.blog/news-insights/research/the-state-of-open-source-and-ai/

How many organizations contribute back?



q0037mrv: Has your organization made any of the following OSS contributions? (select all that apply)



...But how MUCH are they contributing?

Sample Size = 314, Valid Cases = 314, Total Mentions = 695

Adding a maintainers: $1+1 = 1.4?$

“the practice of assigning multiple maintainers to a file **yields only a power of 1/2 increase in productivity** (e.g., four parallel maintainers are needed to double the overall output)”



Source: M Zhou, Q Chen, A Mockus, F Wu, “On the scalability of Linux kernel maintainers' work” ESEC/FSE 2017; dl.acm.org/doi/abs/10.1145/3106237.3106287

Better practices



- Funding sources are fickle - make other plans
- Select/track metrics that matter most to your community
- Documentation is your friend
- Sunsetting is not a failure - have a deprecation plan



Thank you!

