Fundamentals of Software Architecture @ Chalmers University

Scaling DevOps - GitHub’s journey from 500+ to 1500+ people

@jonico/ October 2nd 2020

SAP

OTTO

AUTODESK

DAIMLER

Continental

Allianz

zalando

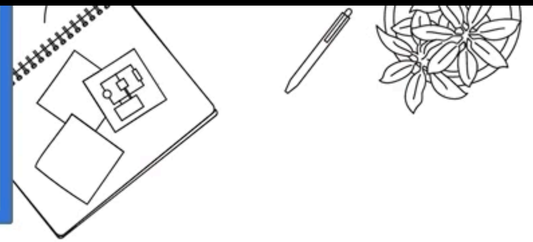
DEUTSCHE BÖRSE GROUP

SCOUT 24

Delivery Hero

games like 2048—which inspired hundreds of clones—have invited even more people to play and create.

Apart from active game development, public source code for some of the most influential games of all time, including Doom and Prince of Persia are archived in public repositories—certainly a better fate than being buried in the New Mexican desert.



22 SEP

GitHub Classroom starts school

GitHub Classroom makes it easier for teachers to distribute starter code and collect assignments on GitHub. Today, students at high schools, universities, and coding bootcamps are learning across 1.8 million Classroom repositories—but these are far from the only educational resources on GitHub.

From lists of resources to massive open online courses (MOOCs) like edX and Udacity, you've created thousands of ways to learn software development on GitHub. Courses at that top our list include Ada's Jumpstart program and Stanford's TensorFlow Tutorials. STAT545 is teaching thousands of students to wrangle data, while CS50 is being adopted in classrooms across the United States.

In the last decade, community-driven programs like Django Girls have kicked off online tutorials, hosted in-person events, and broadened learning opportunities for students around the world. Our Campus Experts are also building tech communities on campuses in more than 15 countries.

what's in it for ME?

GitHub Now vs Then

Repositories

150 M+

vs. 36 M in 2016

Registered users

50 M+

vs. 14 M in 2016

Pull Requests

400 M+

vs. 130 M in 2017

Suggested fixes for security alerts

4 M+

vs. 800 K in 2018

99%

Of software projects use open source

Code

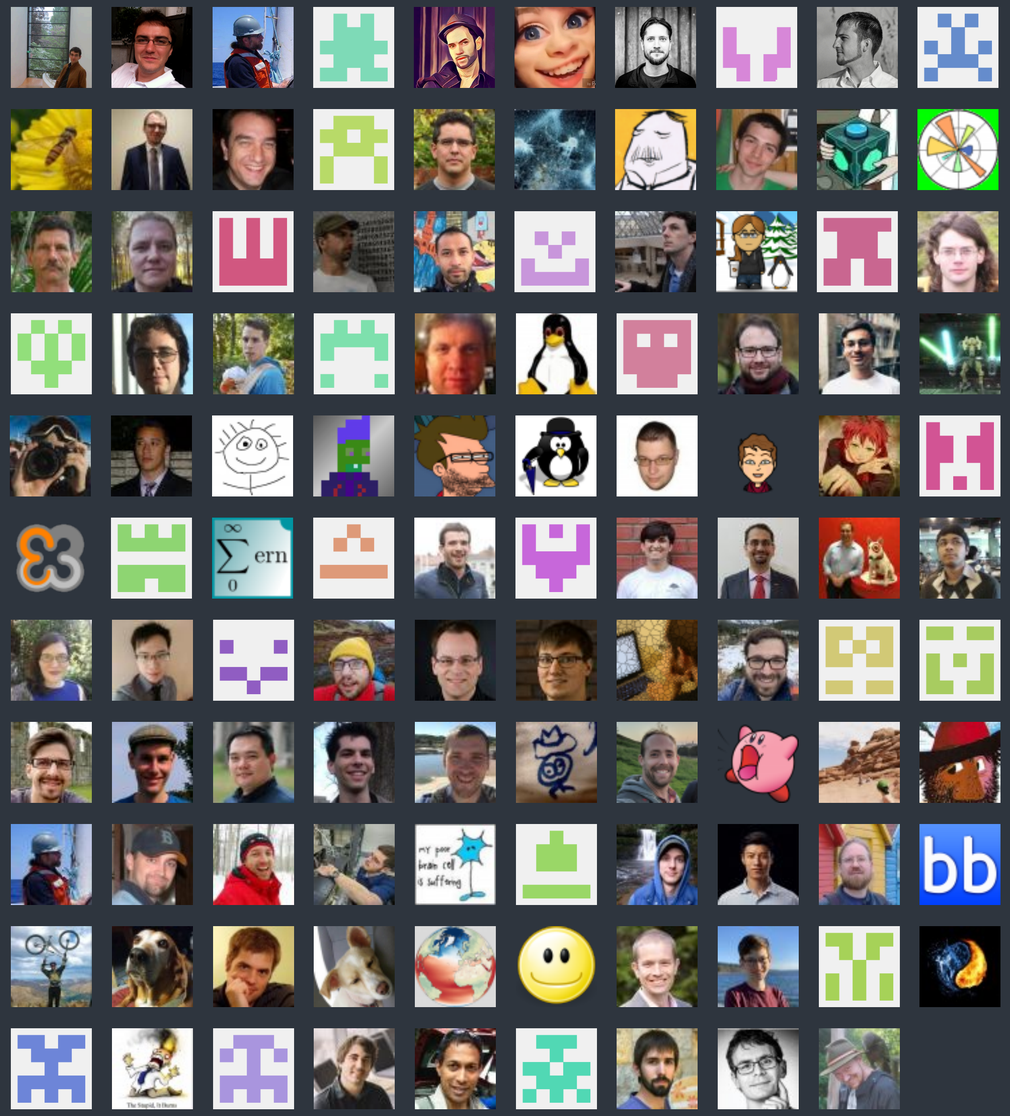
```
import kiwisolver
import numpy

```

Community contributors

Code

```
import kiwisolver
import numpy
import matplotlib
```

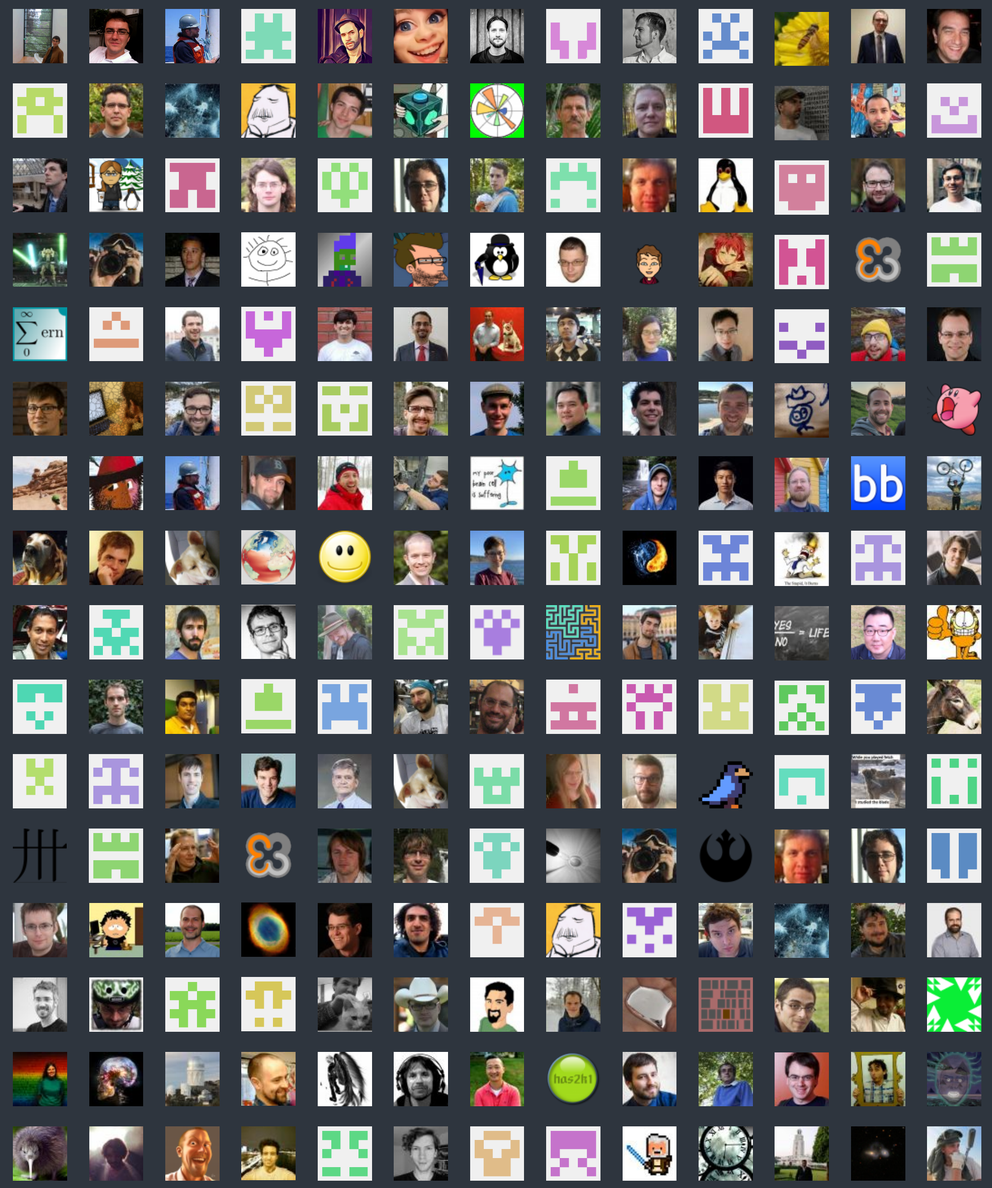
Community contributors



Code

```
import kiwisolver
import numpy
import matplotlib
```

Community contributors



Microsoft

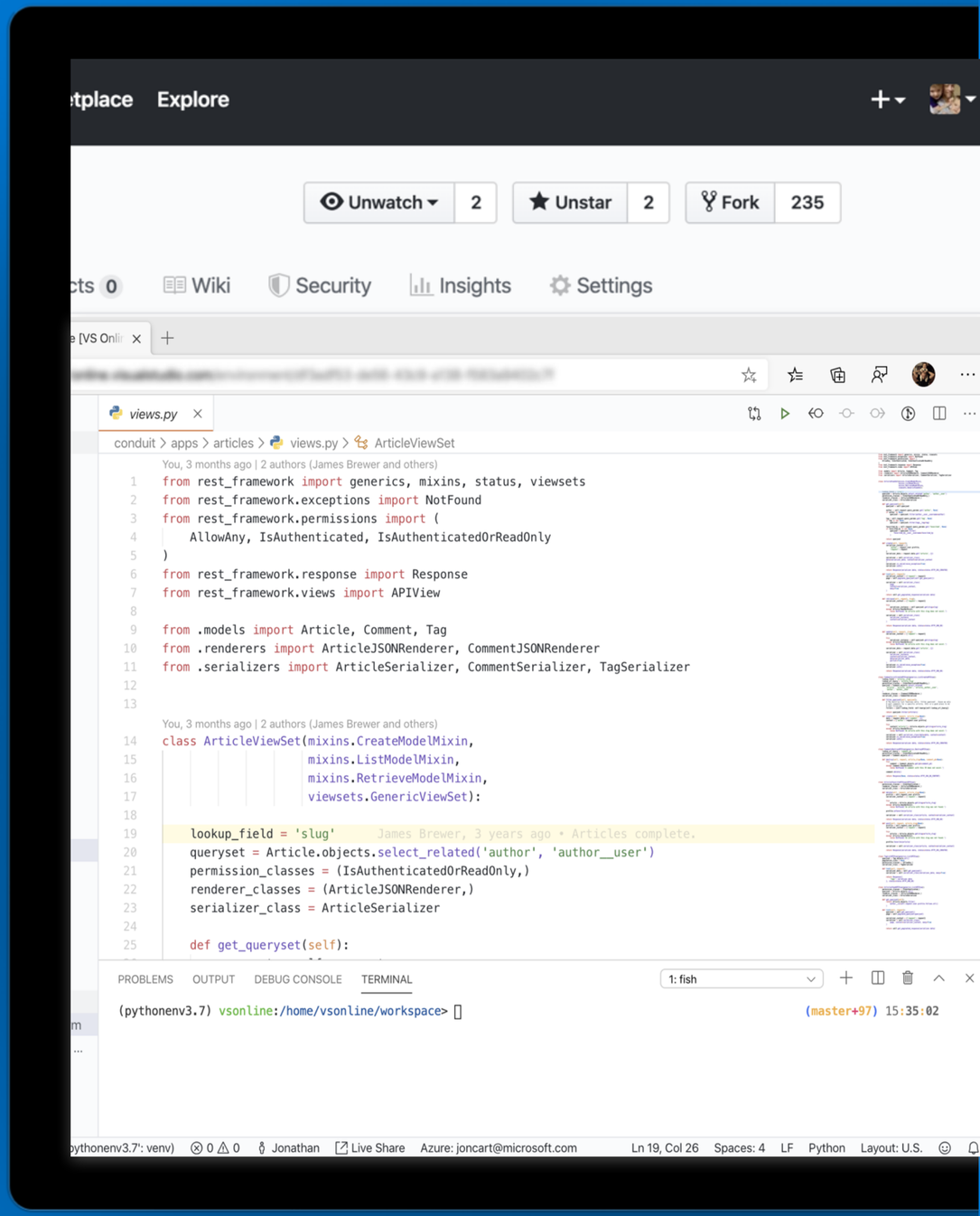
GitHub

Codespaces

Reducing time to set up development environments from hours per week to seconds

Powered by web-based version of VS Code, or use with your desktop IDE

Fully integrated into the GitHub developer experience



One million pull requests

merged with Dependabot

+ npm

+ Semmle

Built with a shared engineering team

Azure DevOps and GitHub share the same leadership, reporting to the GitHub CEO

Bringing the requirements and insights of Azure DevOps customers to GitHub

Standardized tooling for 100k engineers at Microsoft

Open **Introduce GitHub Actions v2** #10
Parameterized gcc version `f0fa028`

Test libzengithub package on main platforms
on: push

- ✕ test (macOS-10.14)
- ● test (windows-2016)
- ● test (windows-2019)
- ✓ test (ubuntu-16.04)
- ✓ **test (ubuntu-18.04)**

✓ **${{ format('Set up Python {0}', matrix.python-version) }}**

✓ **Install C and C++ header files**

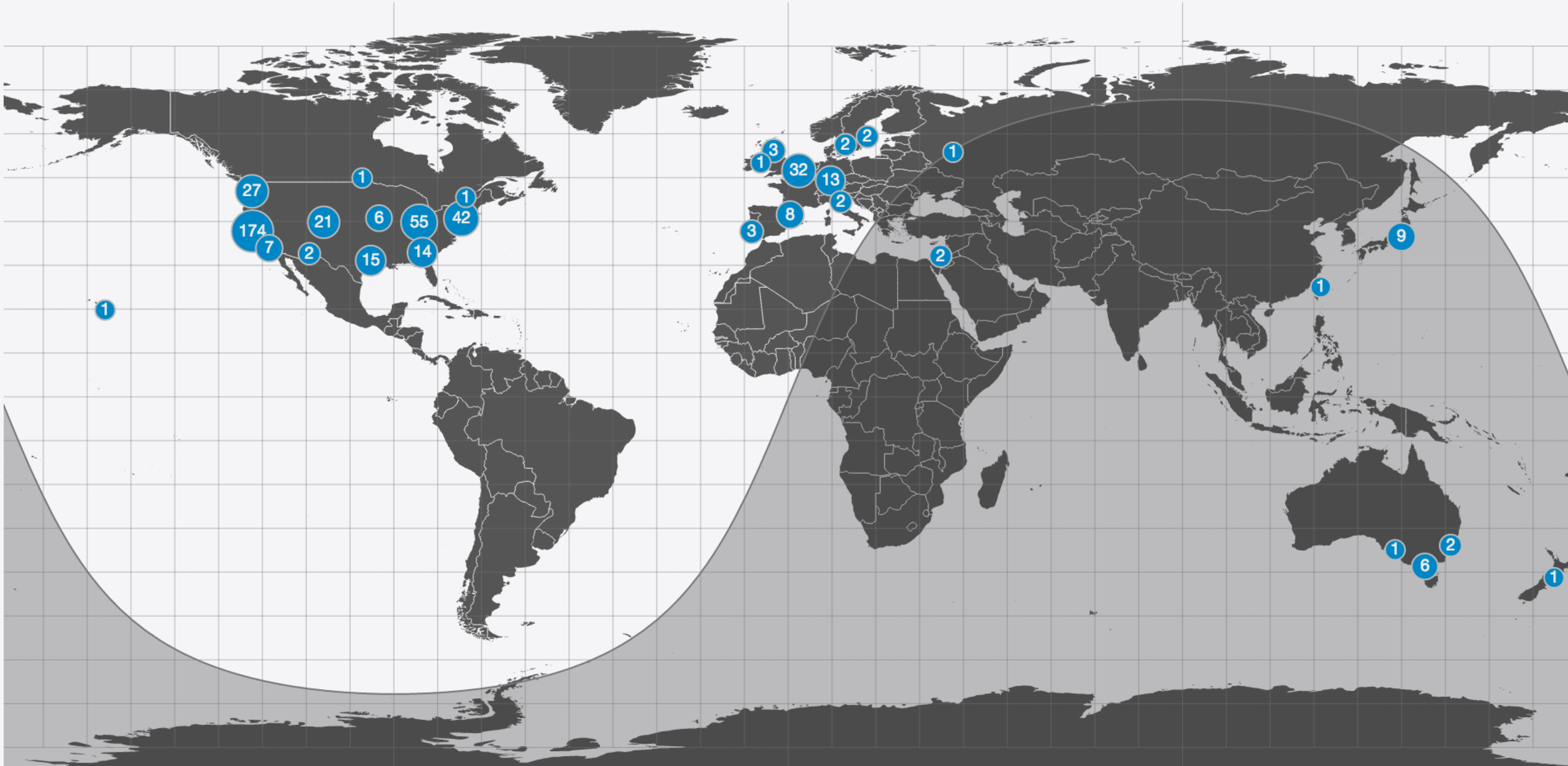
✓ **Install conan && conan package tools**

✓ **Generating conan user directory and building the solution**

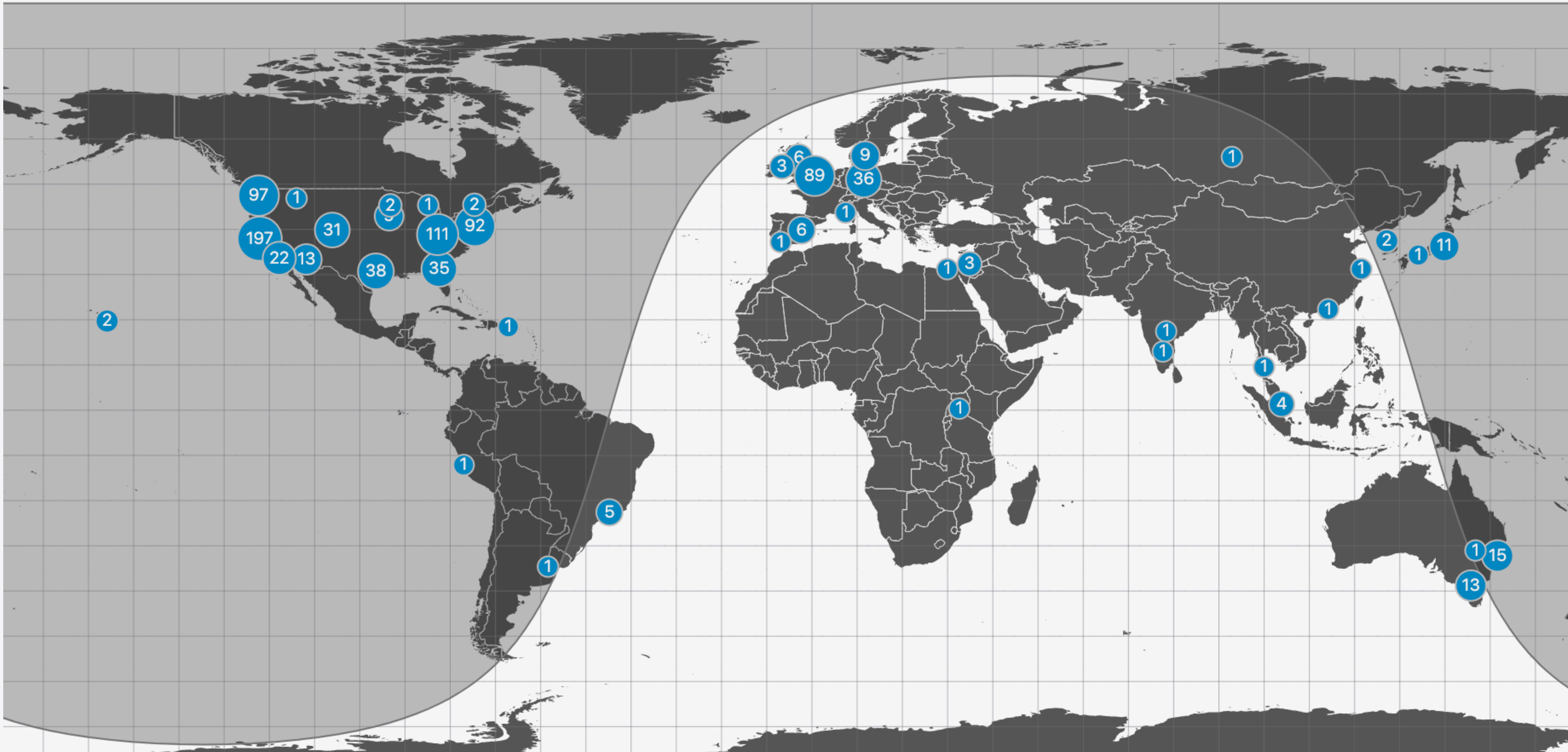
```
ZenGitHub/1.0@jonico/stable (test package): Running test()

                MMM.           .MMM
                MMMMMMMMMMMMMMMMMMM
                MMMMMMMMMMMMMMMMMMM      ___________________________________
               MMMMMMMMMMMMMMMMMMMMM    |                                   |
              MMMMMMMMMMMMMMMMMMMMMMM   | It's not fully shipped until it's fast. |
             MMMMMMMMMMMMMMMMMMMMMMMM   |_   ___________________________________|
             MMMM::- -:::::::- -::MMMM    |/
              MM~:~ 00~:::::~ 00~:~MM
          .. MMMMM::.00:::+:::.00::MMMMM ..
                .MM::::: ._. :::::MM.
                   MMMM;::::::;MMMM
           -MM        MMMMMMM
           ^  M+     MMMMMMMMM
               MMMMMMM MM MM MM
                    MM MM MM MM
                    MM MM MM MM
                 .~~MM~MM~MM~MM~~.
              ~~~~MM:~MM~~~MM~:MM~~~~
             ~~~~~~~==~==~~~~==~==~~~~~~~
              ~~~~~~~==~==~==~==~~~~~~~
                  :~==~==~==~==~~

[HOOK - attribute_checker.py] pre_export(): WARN: Conanfile doesn't have 'description'. It is recommended to add it as attribute
```

✓ **Complete job**

GITHUBBERS	REMOTE	CURRENTLY IN SF	NEW HIRES
574	315 / 54%	256 / 44%	18 / 3%

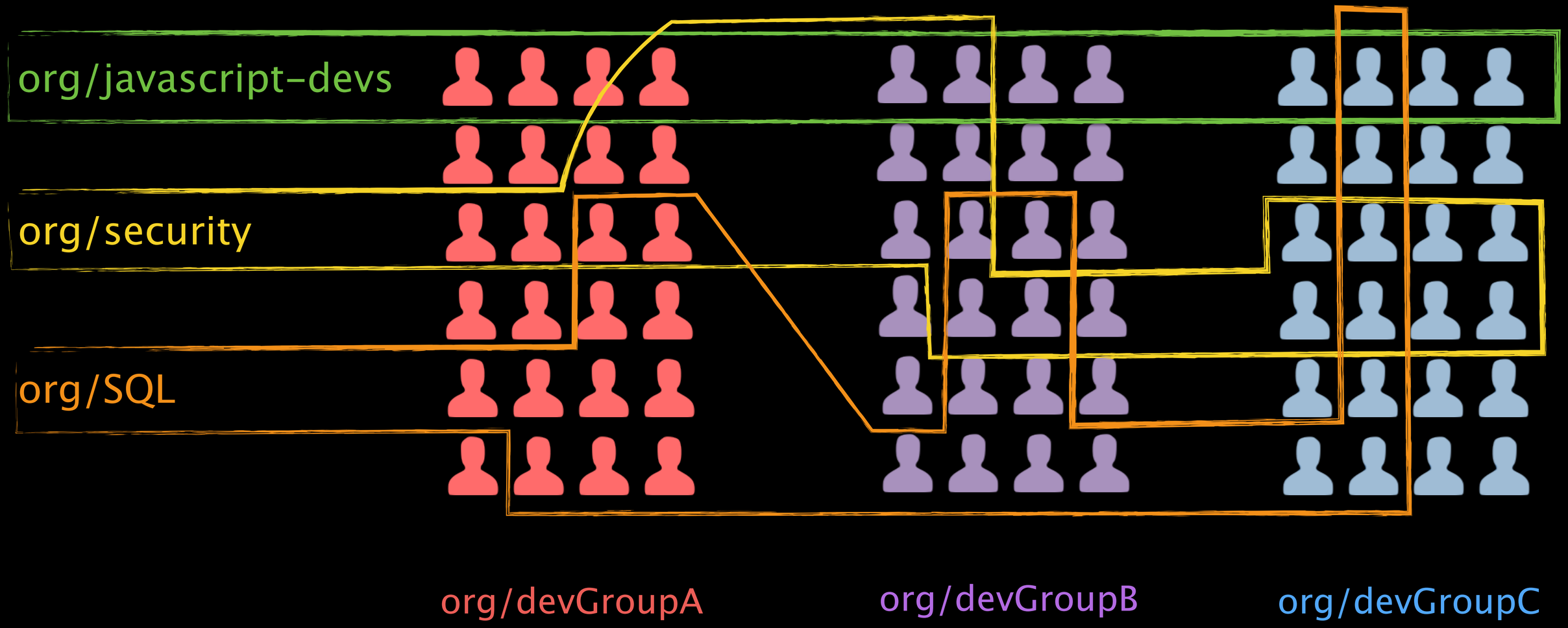


GITHUBBERS	REMOTE	BASED IN SF	NEW HIRES
1613	1229 / 76%	383 / 23%	195 / 12%



Avoid use of emails

If there is no link it does not exist


org/javascript-devs
org/security
org/SQL
org/devGroupA
org/devGroupB
org/devGroupC

More teams than people

Use team @-mentions to communicate across departments

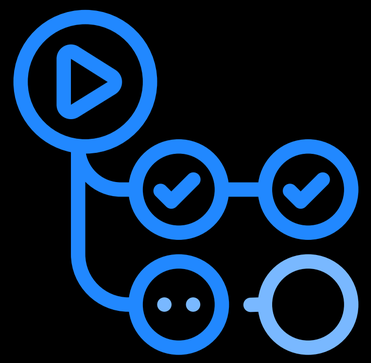
What stayed (and evolved)

Remote First
No Emails

ChatOps
Hubot

What changed heavily

Architecture
Languages



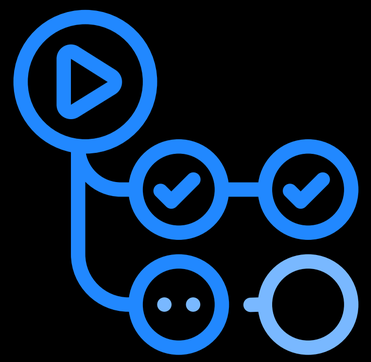
Flaky Test
Detection

Deploy
Trains

what's in it for ME?

Focus For Today

Architecture
Languages



Flaky Test
Detection

ChatOps
Hubot

Architecture / Languages

github
MODA
APPS IN STYLE

From monolith to micro services

From one Ruby/Rails monolith
to many micro services running on Kubernetes,
managed by Moda - GitHub's internal service platform

KubeCon | CloudNativeCon

North America 2017

Keynote: Kubernetes at GitHub

Jesse Newland, Principal Site Reliability Engineer, *GitHub*

0:02 / 19:50

KELSEY GILMORE-INNIS

SITE RELIABILITY ENGINEER
GITHUB

INFRASTRUCTURE AS PRODUCT
BUILDING GITHUB'S FUTURE

UNIVERSE

Full screen (f)
0:09 / 33:17

Paved roads for Ruby, Go, Java, C#

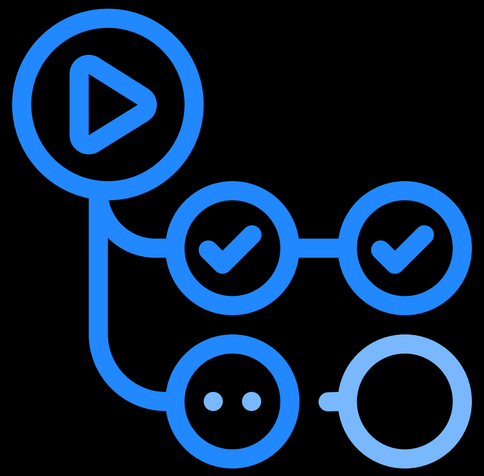
sponsoring team, loosely moderated environment, staffed and moderated environment, containerized releases available to production, test, and development clients, issue tracking for defects and feature requests, release and deprecation policy, roadmap with a plan for future improvements, style guide, supported by automated validation and formatting tooling, set of guidelines / recommendations for when using this language is appropriate, recommended and supported client libraries and workflows, recommendations for IDEs and plugins, automated and documented development workflow approved by relevant stakeholders, automated and documented CI / CD approach approved by relevant stakeholders, vulnerability detection and patch management workflow approved by relevant stakeholders, sample application designed to serve as a consolidated example of best practices, …

Unicorns???

This page is taking way too long to load.

Sorry about that. Please try refreshing and contact us if the problem persists.

Contact Support — GitHub Status — @githubstatus

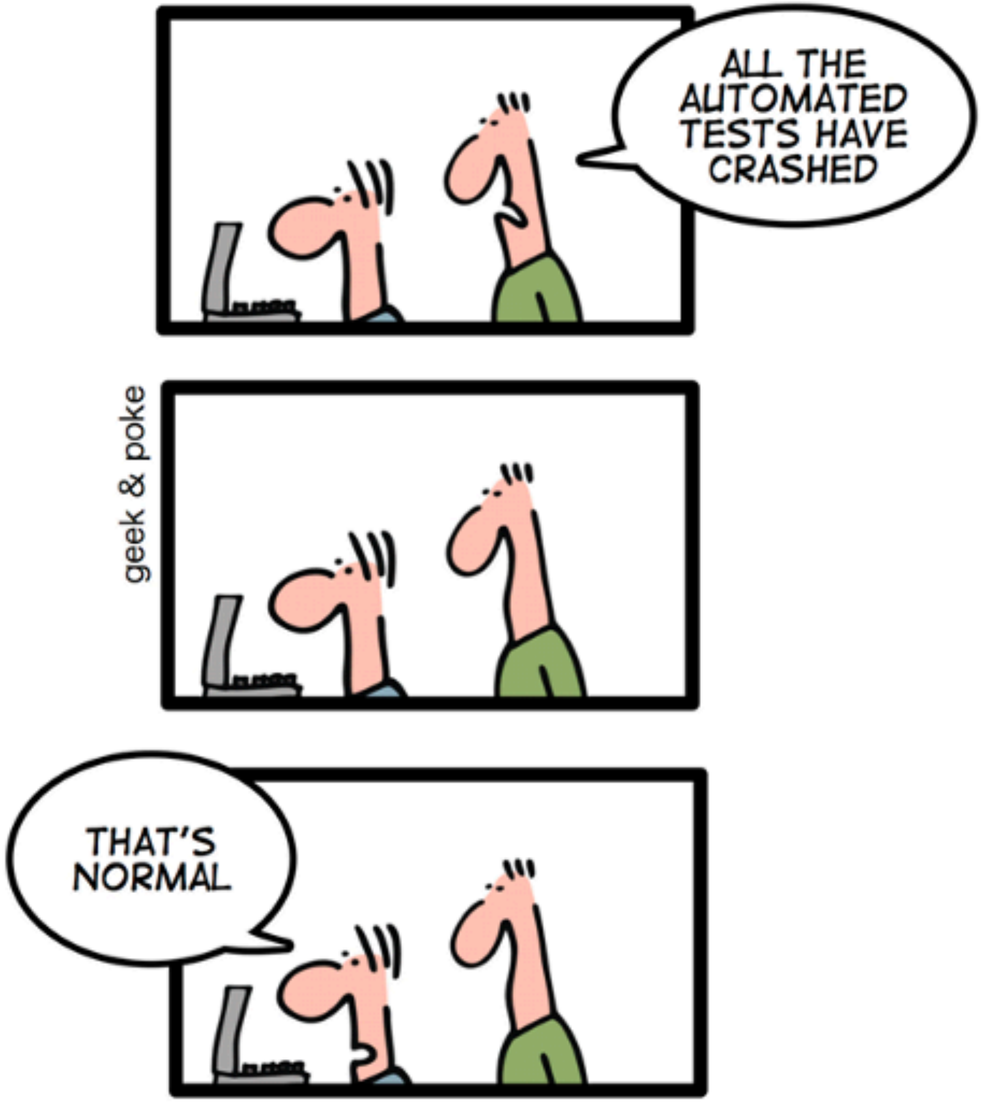


Flaky Test Detection

Confession time

Please raise your hand if you had to deal with flaky tests, i.e. tests that sometimes fail because of

- side effects of test execution order
- Reliance on external services, e.g. a remote HTTP API or time servers
- Current phase of the lunar cycle, cosmic rays, bad luck/karma, etc.



Flaky test math class

Let’s assume a single flaky test fails in 1 out of thousand runs

How big is the like likelihood that an entire test suite run with **n** tests of that sort creates a least one intermittent test failure

$$P_{fail}(n)=1-0.999^n$$

$$P_{fail}(n)=1-0.999^n$$

1 test

$P_{fail}(1)=0.001$

10 tests

$P_{fail}(10)=0.009955$

100 tests

$P_{fail}(100)=0.0952$

1000 tests

$P_{fail}(100)=\mathbf{0.6323}$

30 percent of builds affected

On 2018-12-06, **167 of 545 times**
our github-all-features test suite
would have failed **if it were not for marked flakes**

What’s a flake candidate

- A flake candidate is a test that
  - both passes and fails against the same code (git tree) where less than 50 tests were failing
  - have been experienced by more than 1 user, on more than 1 branch
  - will be automatically captured and logged by the CI system by re-running failed tests

- Each flake candidate, has a SHA as identifier. The SHA is determined by:
  - Test name
  - Test suite
  - The first significant line of the exception stack trace

Open Flakes | Closed Flakes | Flake Candidates

0 Selected 144 Total
NWO: github/github
Buildables: github, github-all-features, enterprise
Clear Add

TeamDestructionDestroyOperationContext / caf0604f8f7
Test two operations race
Clear Add

github-all-features / test-make-rails-6-default Flake Candidate
Occurred about 1 hour ago • Built at 2019-08-20 13:20:37 UTC • Built on janky-nunix-

github-all-features / steves-analytics Flake Candidate
Occurred 4 days ago • Built at 2019-08-16 18:01:13 UTC • Built on janky-nunix-f57d910.private-us-east-1.github.net

github-all-features / queue-prep-t Flake Candidate
Occurred 5 days ago • Built at 2019-08-15 15:28:16 UTC • Built on janky-nunix-t

github-all-features / sponsors-criteria-migration Flake Candidate
Occurred 13 days ago • Built at 2019-08-07 19:50:51 UTC • Built on janky-nunix-t

github-all-features / split-up-get-refs-endpoint Flake Candidate
Occurred 19 days ago • Built at 2019-08-01 14:35:23 UTC • Built on janky-nunix-f

TeamDestructionDestroyOperationContext / 93ff7a917b0b36583
Test throttle the deletes
Clear Add

github-all-features / test-make-rails-6-default Flake Candidate
Occurred about 1 hour ago • Built at 2019-08-20 13:20:37 UTC • Built on janky-nunix-t

github-all-features / steves-analytics Flake Candidate
Occurred 4 days ago • Built at 2019-08-16 18:01:13 UTC • Built on janky-nunix-

What’s a flake

- Flake candidates that are manually inspected by a developer and identified as intermittent test failures can be turned into real flakes (via ChatOps and Janky UI).
- CI builds will still succeed if < 30 flakes failed (and all other tests pass)
- Flakes are identified as issues in github/github with the label of failing-test, multiple flake candidates can belong to the same issue
- All open flake have assigned owners and a deadline (1 week) to fix, else the test should rather be deleted
- Closing a flake is as simple as closing the issue. If an intermittent test failure reappears within 5 days, it will reopen the flake issue.

Flaky test detection allows 30 percent more deployments

Flaky tests detection

Build #15378054 (481472e) of github-build-deploy-tarball-bp/master was successful (437s, queued 3s)

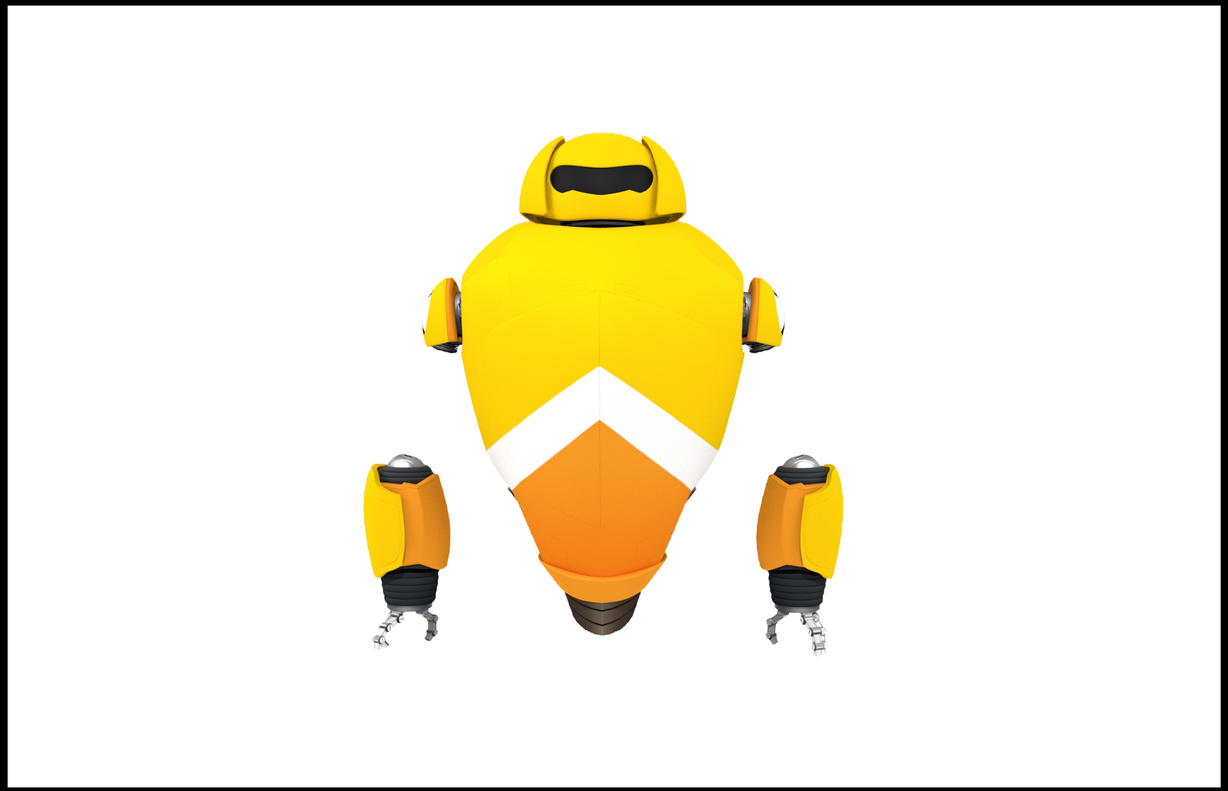
Build #15378045 (481472e) of enterprise/master failed with 8 known flakes - 9 failures (433s, queued 4s)

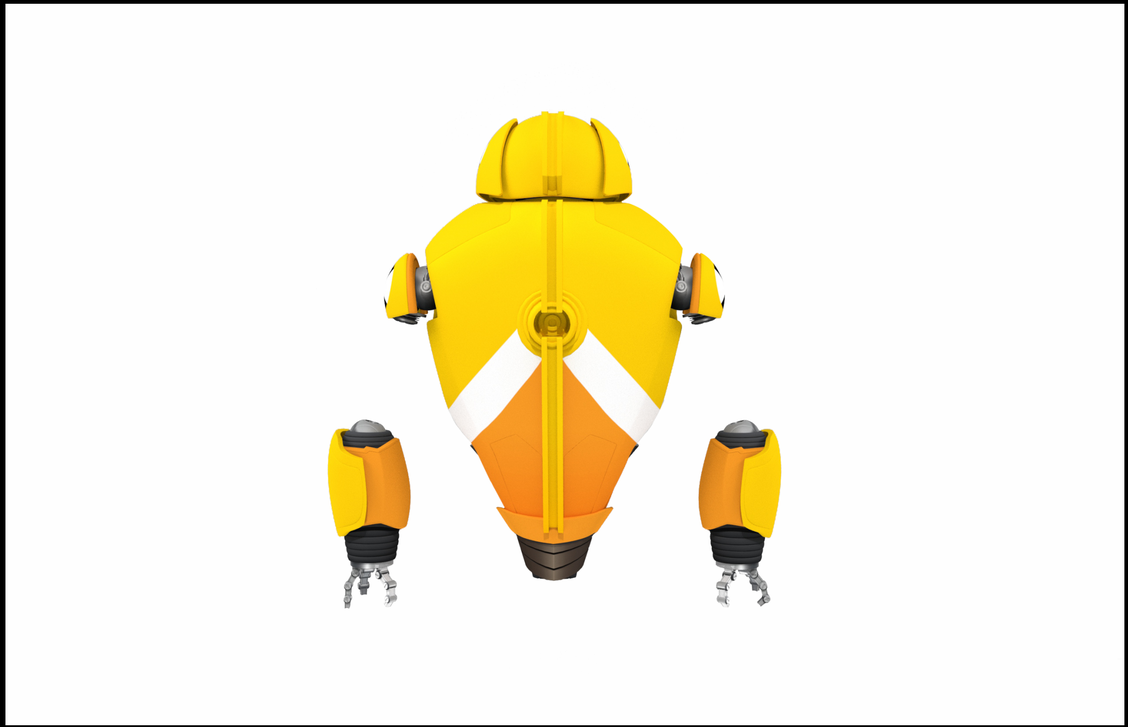
Build #15378071 (481472e) of github-rails-next/master was successful with 12 known flakes (440s, queued 3s)

latentflip 8:59 AM

.ci flakes add github 186b00f5f68c436c94e0dc4912bc3e80 https://github.com/github/github/issues/109058

ChatOps





Hubot

WIRED The Most Important Startup's Hardest Worker Isn't a Person SUBSCRIBE

BUSINESS | CULTURE | DESIGN | GEAR | SCIENCE | SECURITY | TRANSPORTATION

SHARE

SHARE 874

TWEET

PIN

COMMENT 11

EMAIL

CADE METZ BUSINESS 10.23.15 7:00 AM

THE MOST IMPORTANT STARTUP'S HARDEST WORKER ISN'T A PERSON

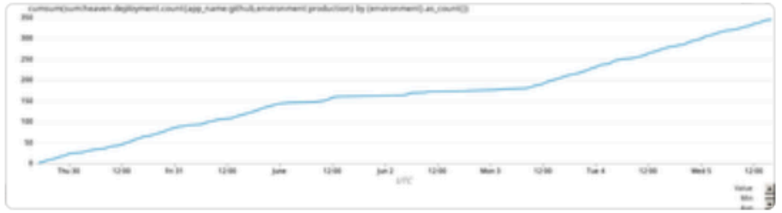
'It's a new way of working.'

—SAM LAMBERT, GITHUB

Sam Lambert, the director of systems at GitHub, calls Hubot "the hardest working GitHubber." That's a company-wide in-joke. Hubot isn't really a GitHubber. He's a bit of software that plugs into the GitHub chat system. About five years ago, a guy named Ryan Tomayko built Hubot as an easier way for the company's engineers to manage and modify all the hardware and software underpinning GitHub.com. Simply by sending a message to Hubot—much as they'd send a message to anyone else from inside the GitHub chat client—engineers could update the operating

brntbeer 6:08 PM
.dgraph -1w cumsum(sum:heaven.deployment.count{app_name:githu

hubot APP 6:09 PM
cumsum(sum:heaven.deployment.count{app_name:github,enviro
by {environment}.as_count()) (23 kB)



carlosmn 11:45 AM
.maint enable gitbackups-maintenance- destroying

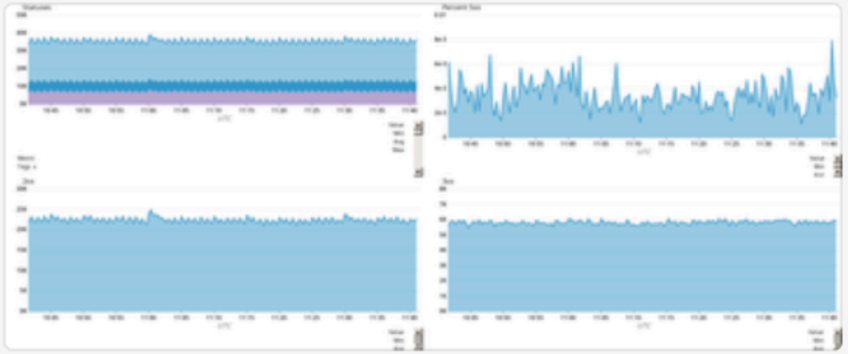
hubot APP 11:45 AM
@carlosmn: authentication required for `.maint enable`. Check your mobile device.

hubot APP 11:45 AM
gitbackups-maintenance- - maintenance mode enabled successfully! Window will expire in 60 minutes.

carlosmn 11:47 AM
.instance destroy hostname=gitbackups-maintenance-

brntbeer 1:41 PM
.dash me -1h glb.services --glb-service dotcom

hubot APP 1:41 PM
glb.services (117 kB)

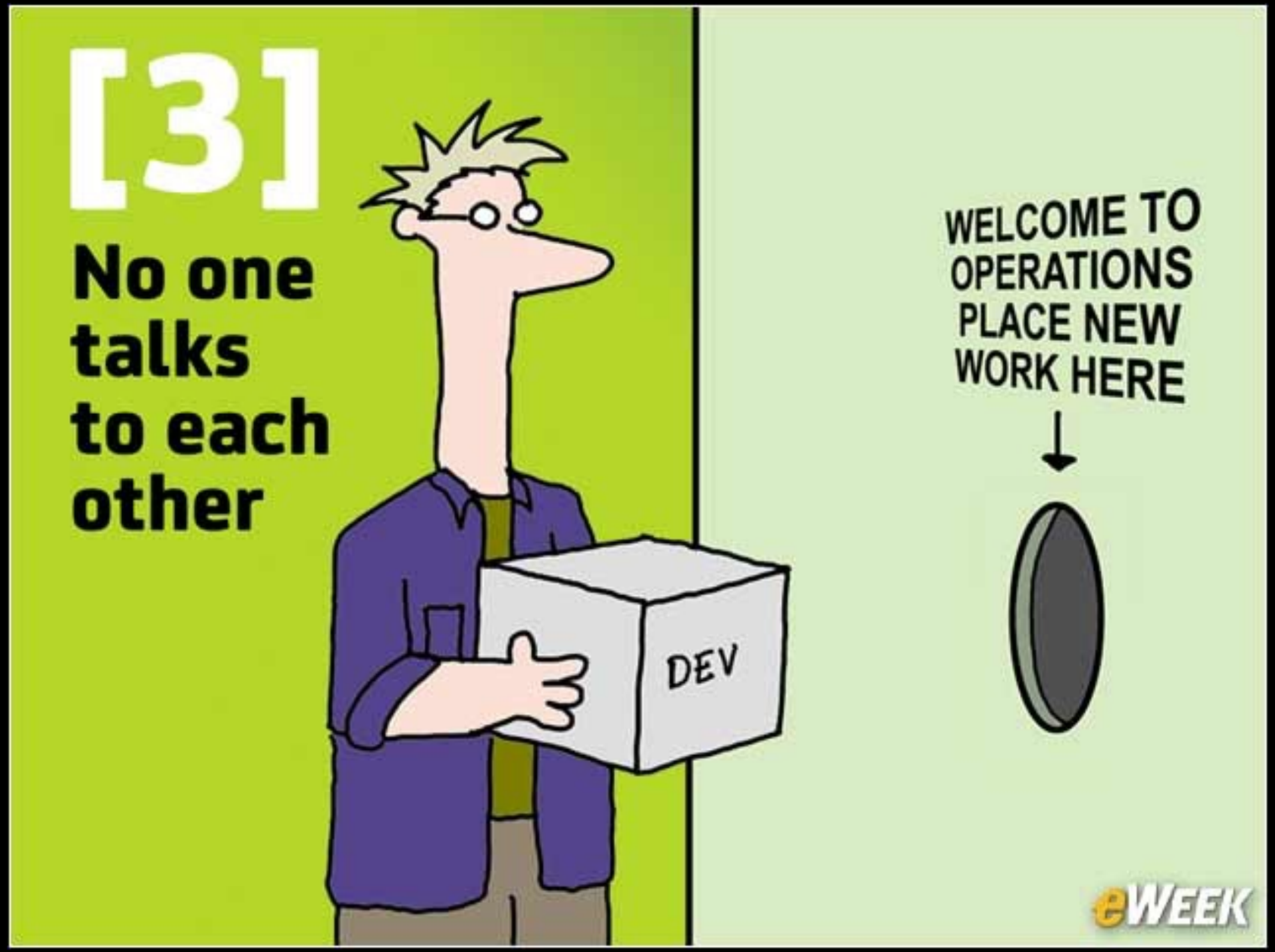


brntbeer 1:51 PM
.catalog owner notifications

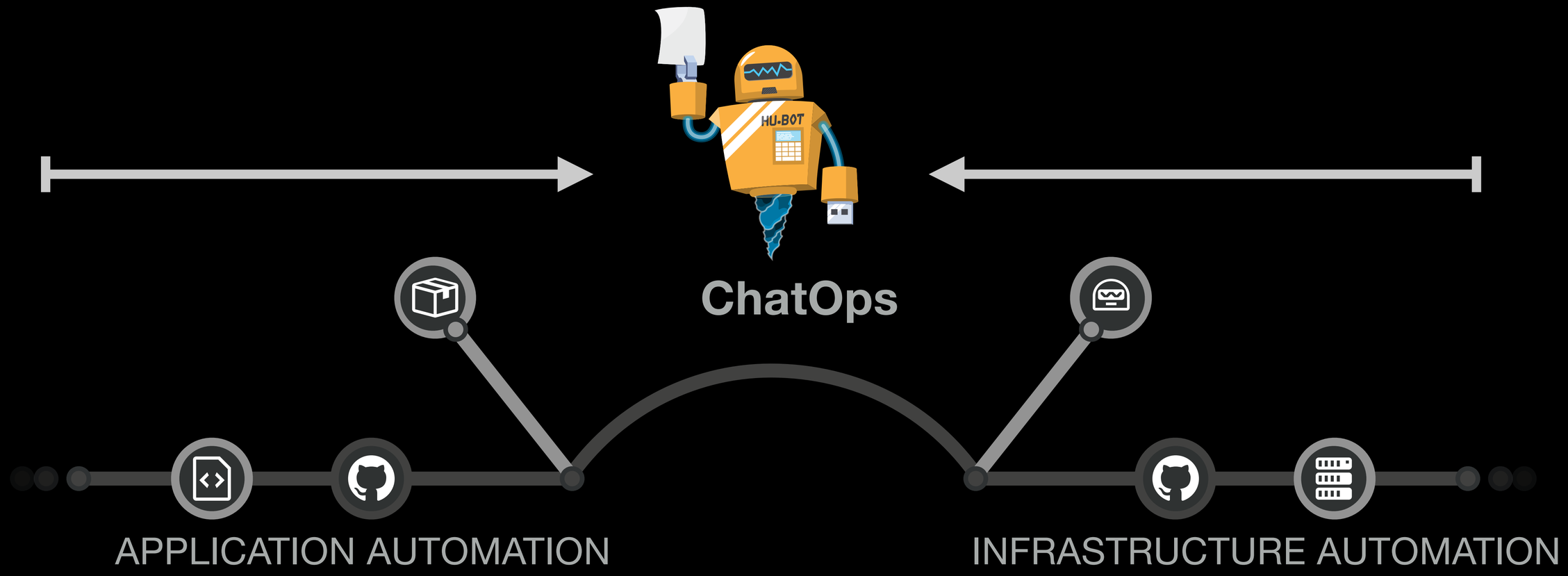
hubot APP 1:51 PM
Service: notifications
Maintainer: shayfrendt
Team: github/pe-notifications

Escalation Paths:
sev1: `.pager trigger github-dotcom-oncall critical <reason>`
sev2: https://github.com/github/github/issues
sev3: #pe-notifications

WORKED FINE IN DEV
OPS PROBLEM NOW
memegenerator.net


[3]
No one talks to each other
DEV
WELCOME TO OPERATIONS PLACE NEW WORK HERE
eWEEK

ChatOps as the cultural glue



jonahberquist 6:46 PM
.mysqlproxy disable github [redacted]

hubot BOT 6:46 PM

> disabling github-[redacted]
>
> github-[redacted]:
> disabled server mysql/github-[redacted] Show more...

tomkrouper 6:47 PM
Do we want to re-up durability on a couple replicas to make sure that is fine?

samlambert 6:47 PM
.status green

hubot BOT 6:47 PM

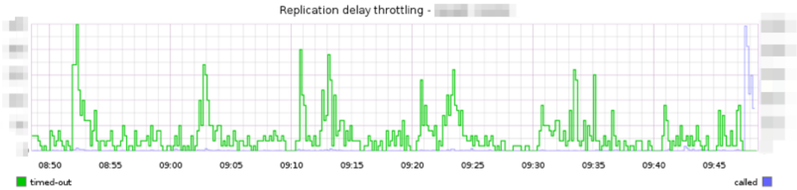
> samlambert: Status updated to green

> samlambert: I updated GitHub Chat's status, too.

zerowidth 6:48 PM
.graph me -1h alias(alpha(secondYAxis(github [redacted]),0.5),"called") + aliasByNode(maximumAbove(github [redacted] timed-out,0),3) + title=Replication+delay+throttling+-+mysql1+cluster&hideLegend=false&template=plain&lineMode=staircase

jnunemaker 6:48 PM
deploying doubling the threshold for user session writes

hubot BOT 6:48 PM

> Graph Me
> (30KB)
>
> 
>

https://hubot.github.com

PASTE EMBLEM HERE

HUBOT

(note: it's pronounced hew-bot)

1. GIVEN NAME OF INVENTION
PLEASE INCLUDE ANY PRONUNCIATION NUANCES

A CUSTOMIZABLE,
LIFE EMBETTERMENT ROBOT

2. DESCRIPTION OF INVENTION
PLEASE BE AS CLEAR AND CONCISE AS POSSIBLE

COMMISSIONED BY GITHUB

4. AFFILIATED COMPANY
INCLUDE AFFILIATED COMPANY LOGO (IF APPLICABLE)

5. SIGNATURE OF INVENTOR
PLEASE DO NOT ATTEMPT TO SIGN WHILE INEBRIATED

☐ **VIEW HUBOT'S DOCUMENTATION**
(LEARN ABOUT GETTING STARTED, ETC.)

☐ **VIEW HUBOT'S SOURCE CODE**
(VIA HTTP://GITHUB.COM/GITHUB/HUBOT/.)

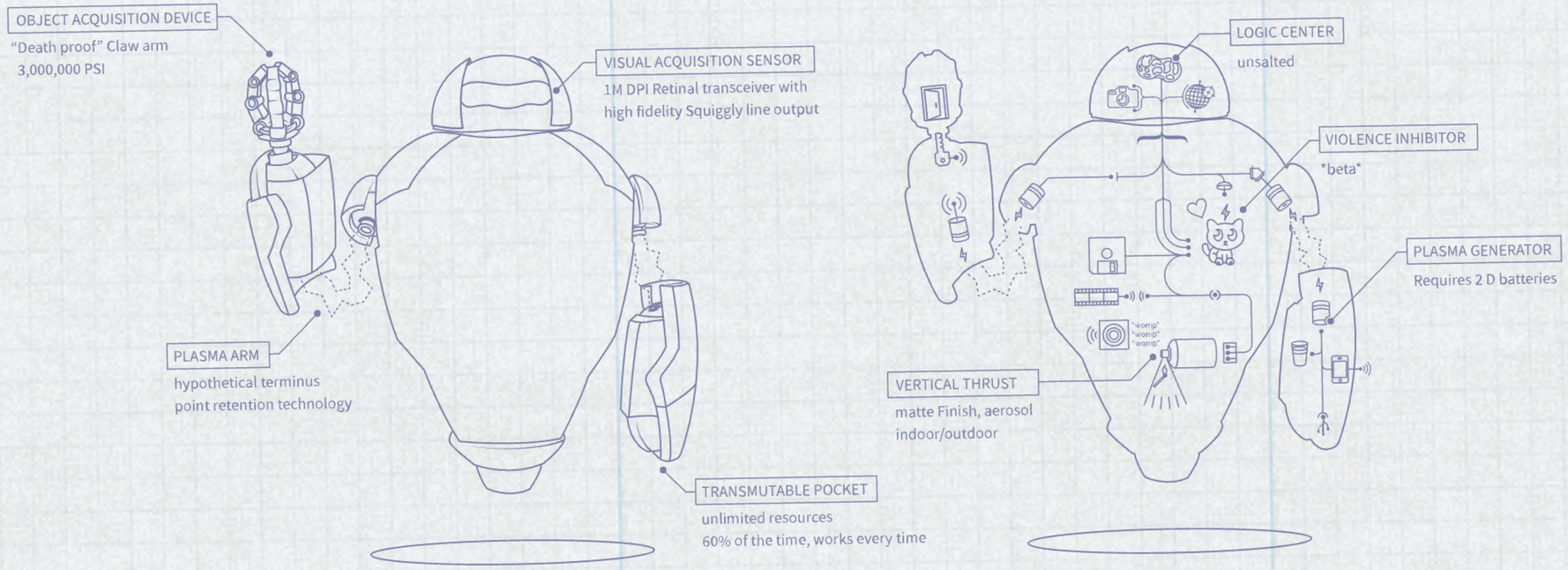


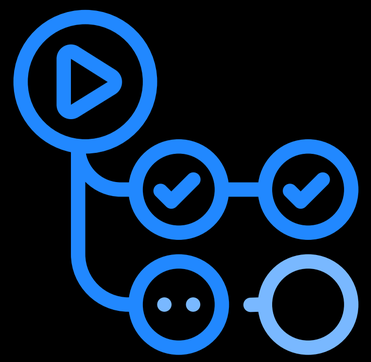
FIG. 1 — HUBOT SCHEMATICS

Summary

what's in it for ME?

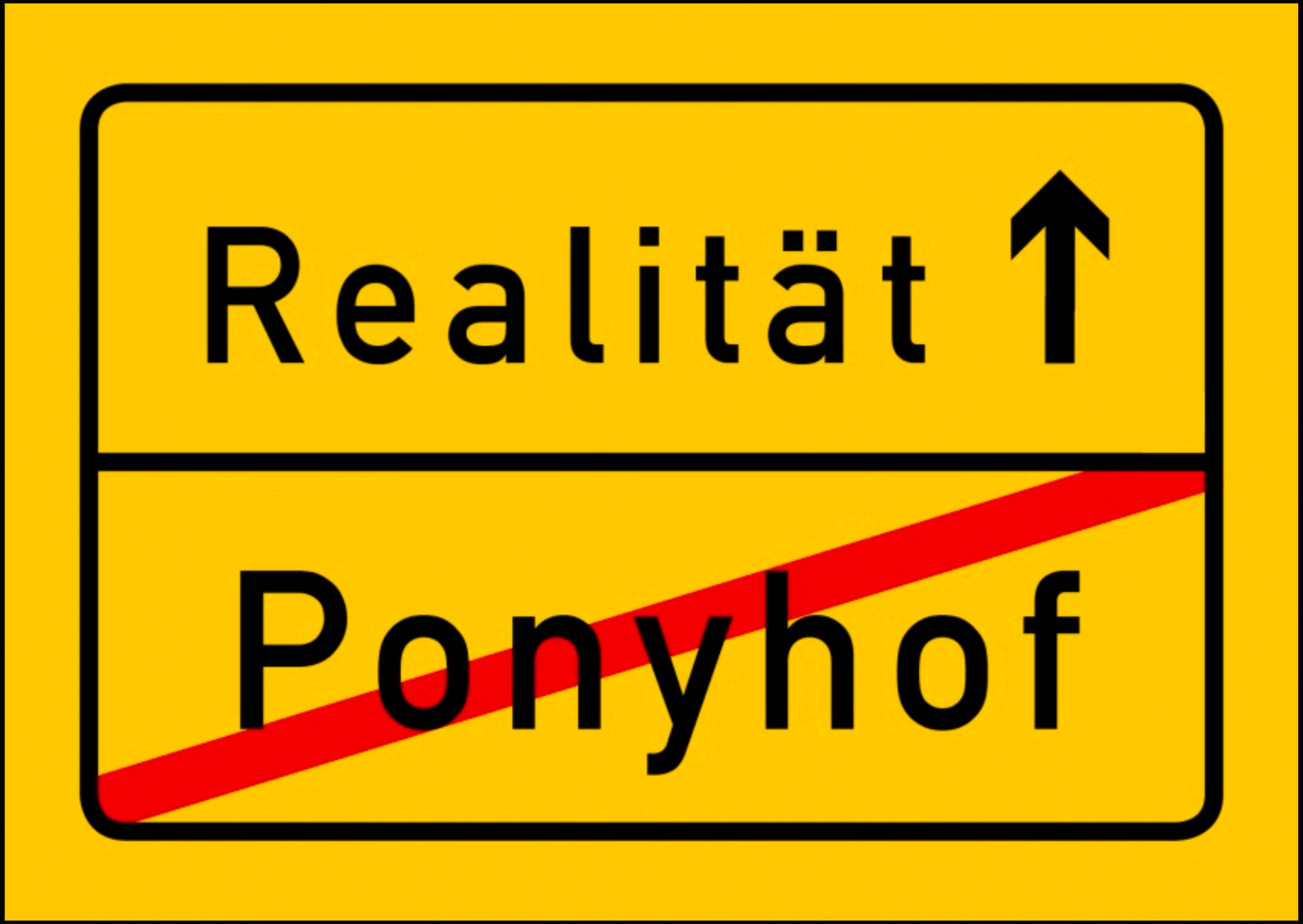
Focus For Today

Architecture
Languages



Flaky Test
Detection

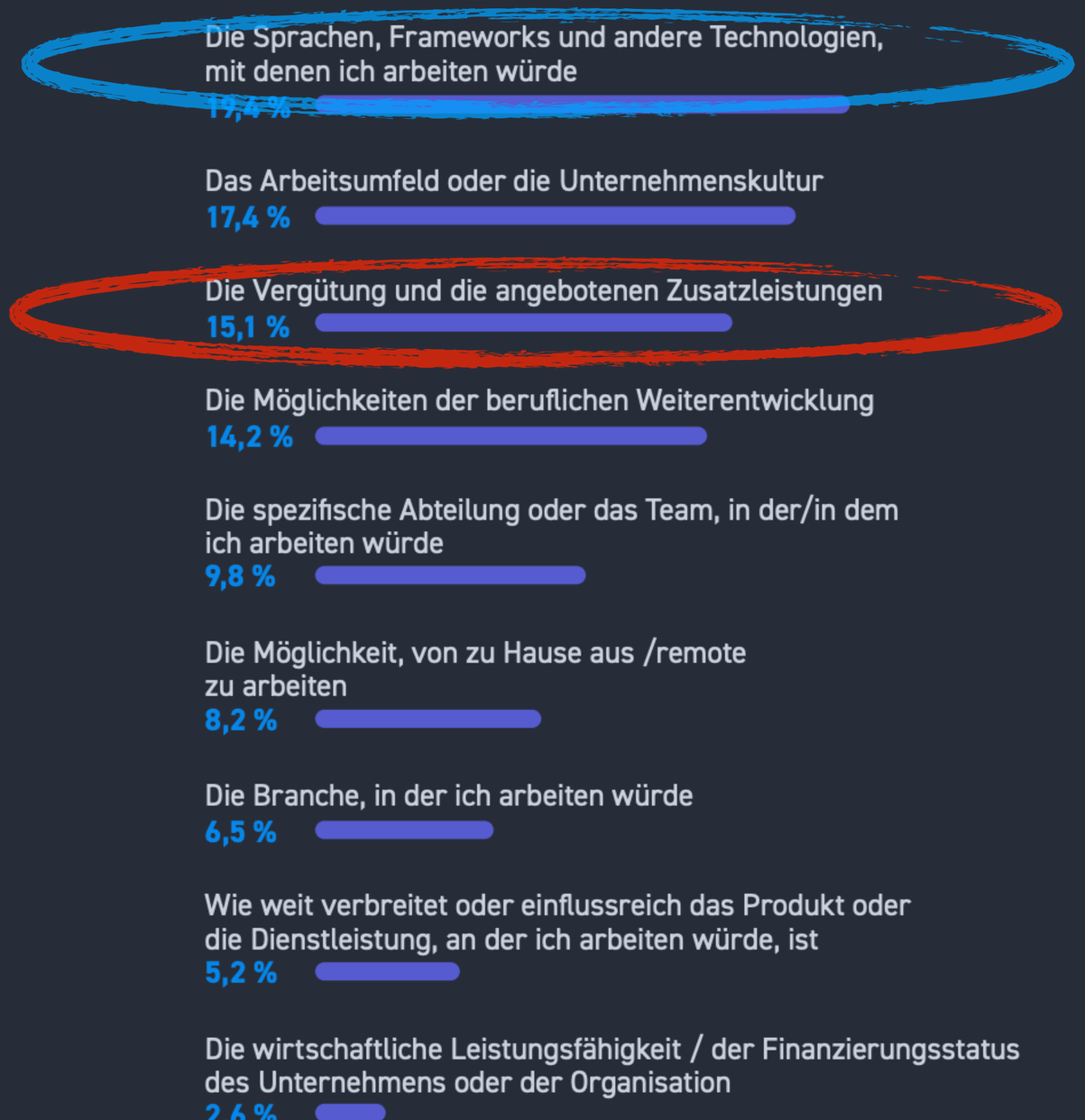
ChatOps
Hubot


Realität
Ponyhof

Was bei einem neuen Job wichtig ist

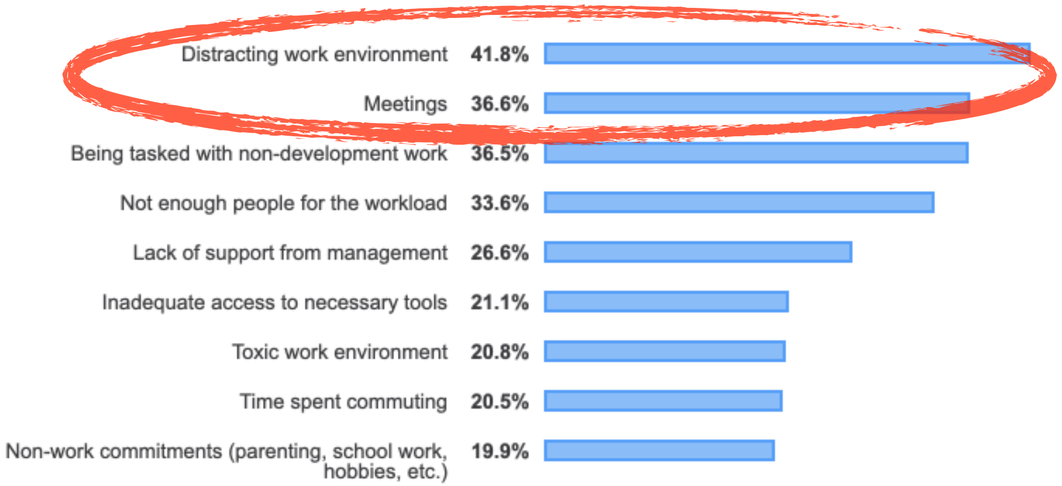
In Deutschland stehen bei der Beurteilung eines Arbeitsplatzes die spezifischen Technologien im Vordergrund, gefolgt von der Büroumgebung und der Unternehmenskultur. Die Technikbranche kämpft insgesamt mit Problemen rund um die Vielfalt und im Allgemeinen machen Entwickler sie nicht zu einer Priorität bei der Suche nach einem Job. Deutsche Entwickler, die einer geschlechtsspezifischen Minderheit angehören (Frauen, nicht binär), schätzen die Vielfalt in einer Organisation eher.

Wie Entwickler potenzielle Arbeitsplätze bewerten: Höchste Priorität



Greatest Challenges to Productivity

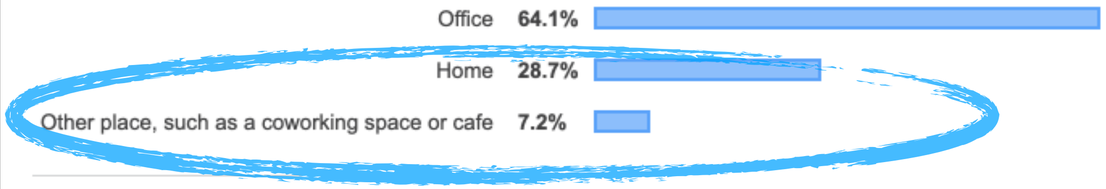
All Respondents | Men | Women | Non-binary



68,141 responses; select up to three

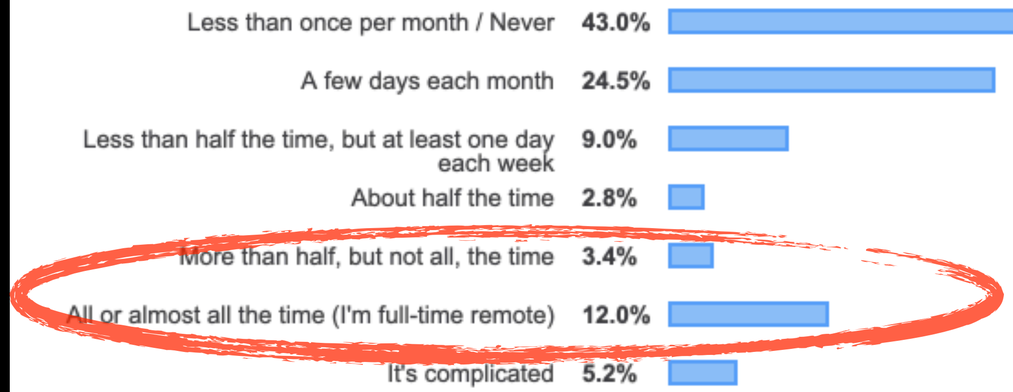
Where Do Developers Want to Work?

Overall | United States | India | United Kingdom | Germany | Canada



4,660 responses

How Often Do Developers Work Remotely?

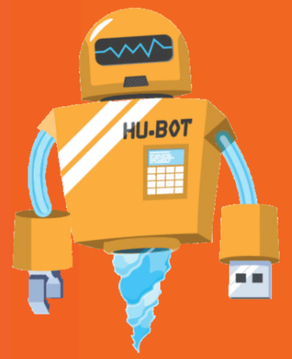


70,284 responses

@jonico

HOW THE FUTURE OF SOFTWARE HAS TO BE DIFFERENT

“Es ist nicht deine Schuld, dass der Code ist wie er ist, es wär’ nur deine Schuld, wenn er so bleibt.”



Thank you