

Onboarding vs. Productivity, Diversity and Quality

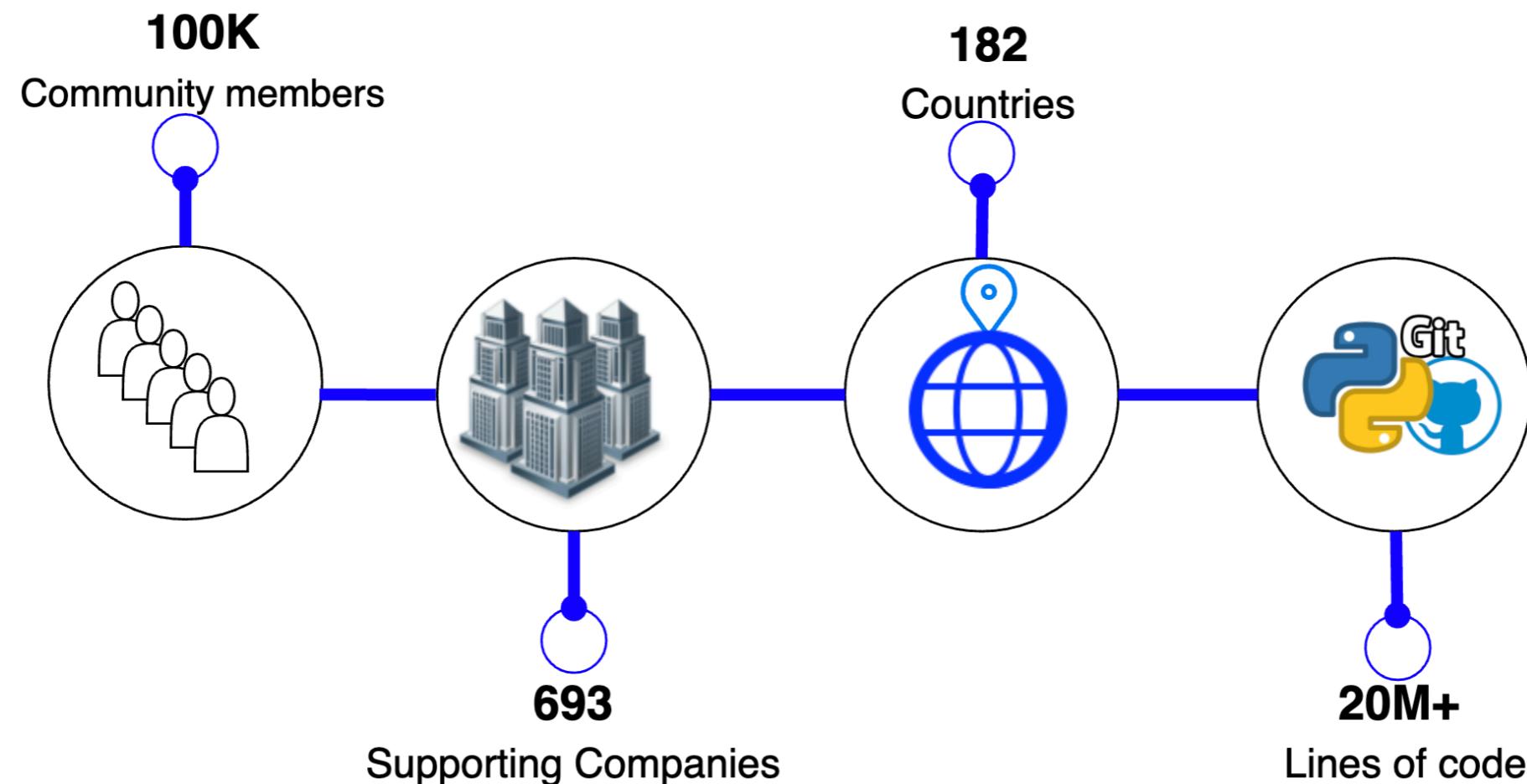
– Empirical Study of the OpenStack Ecosystem

Armstrong Foundjem, Ellis Eghan, Bram Adams

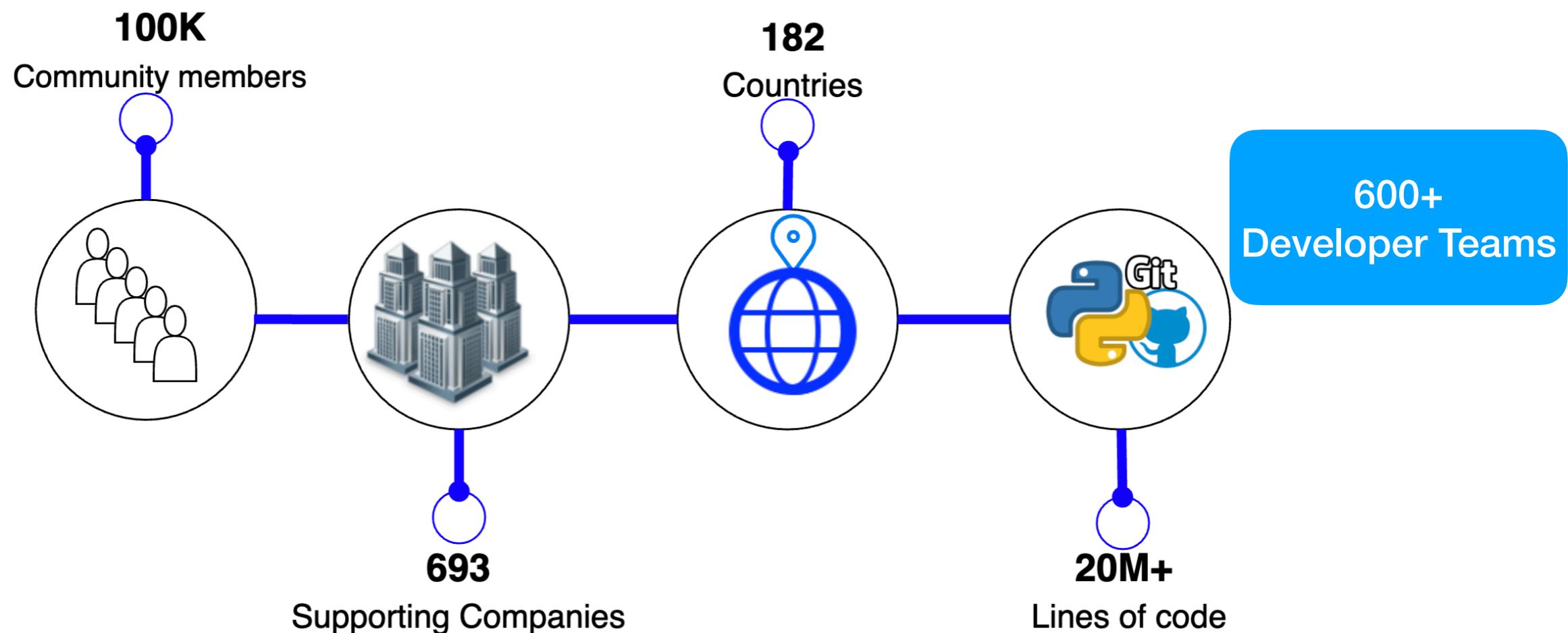
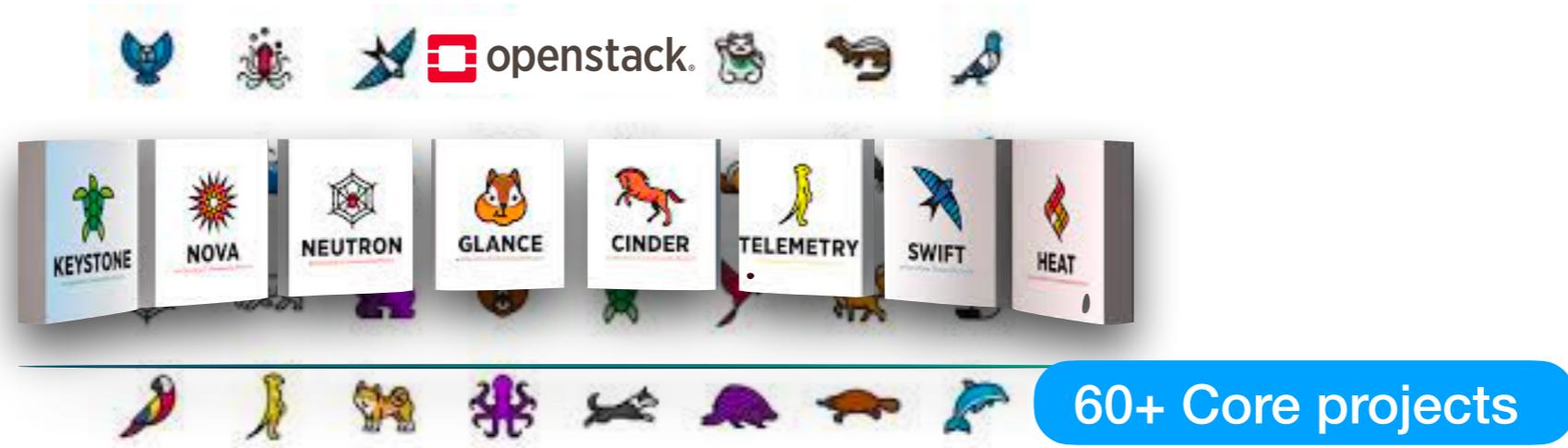
MCIS Laboratory
a.foundjem@queensu.ca

ICSE 2021

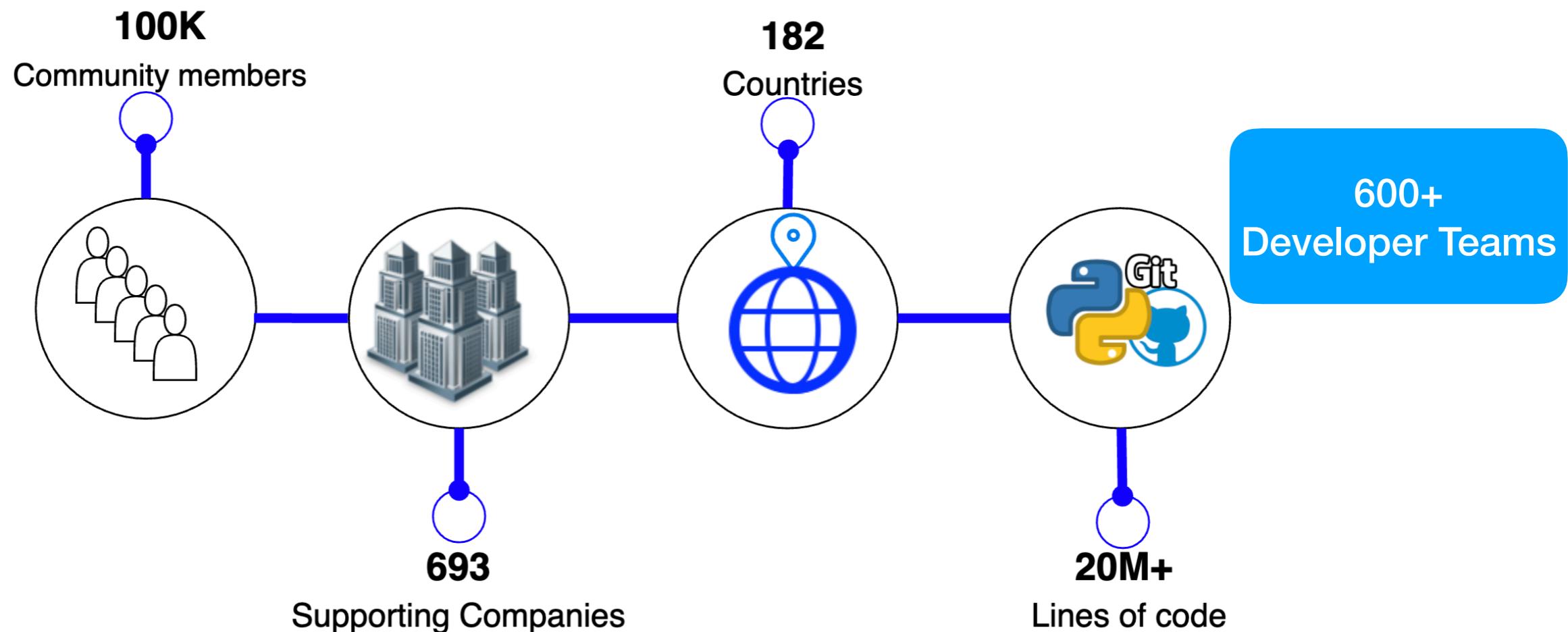
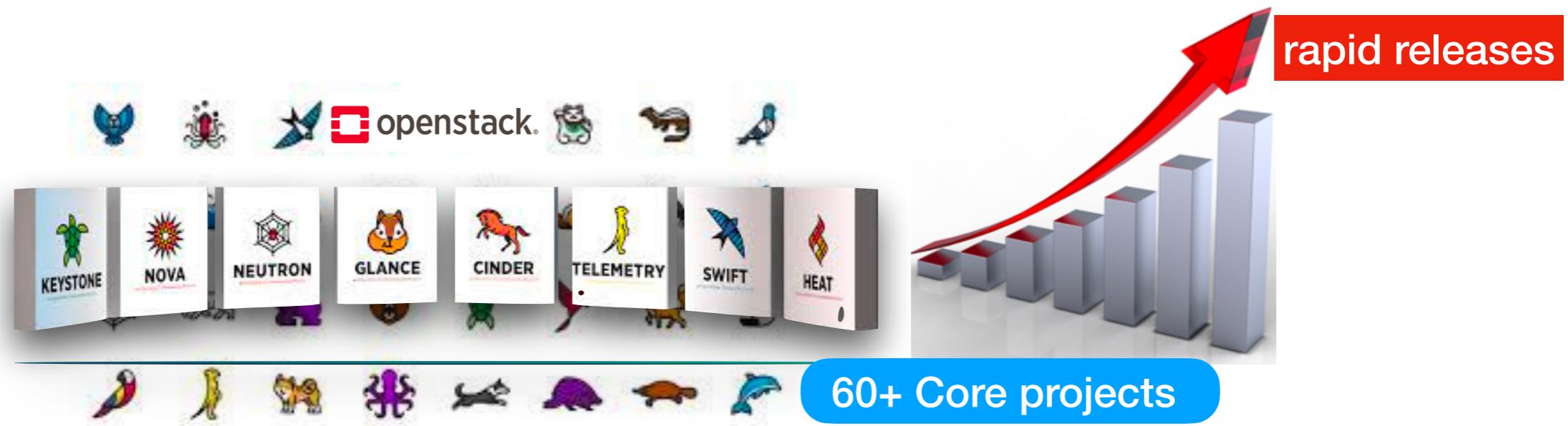
OpenStack: An Open Source Software Ecosystem (SECO)



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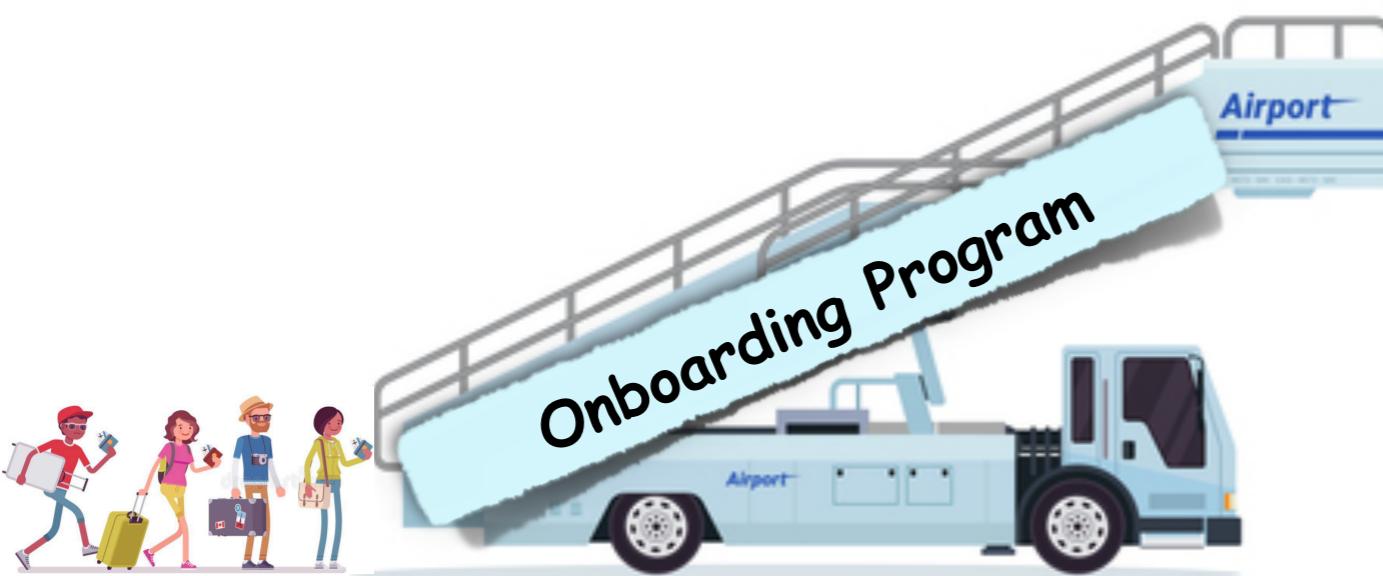
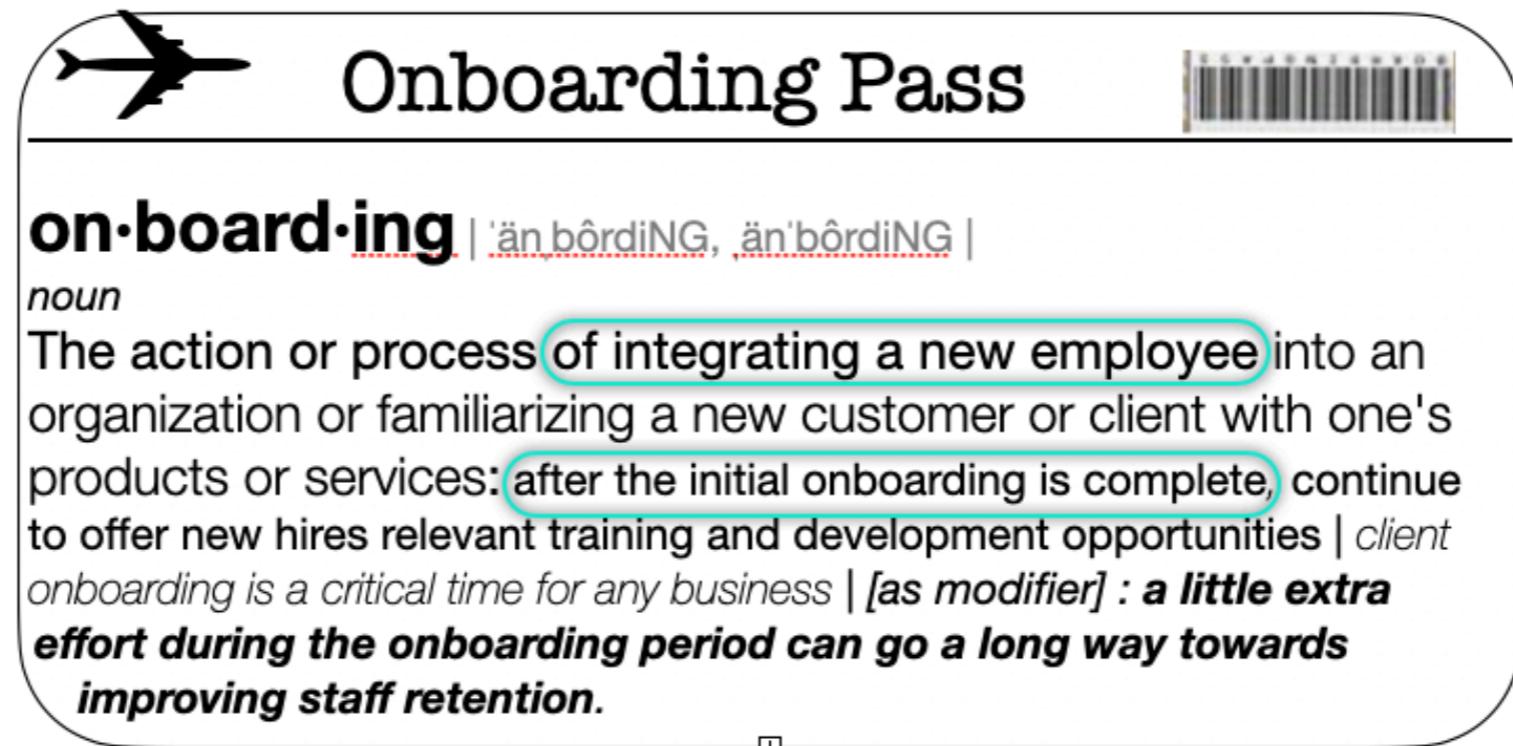
How to Start Contributing to Such A SECO?

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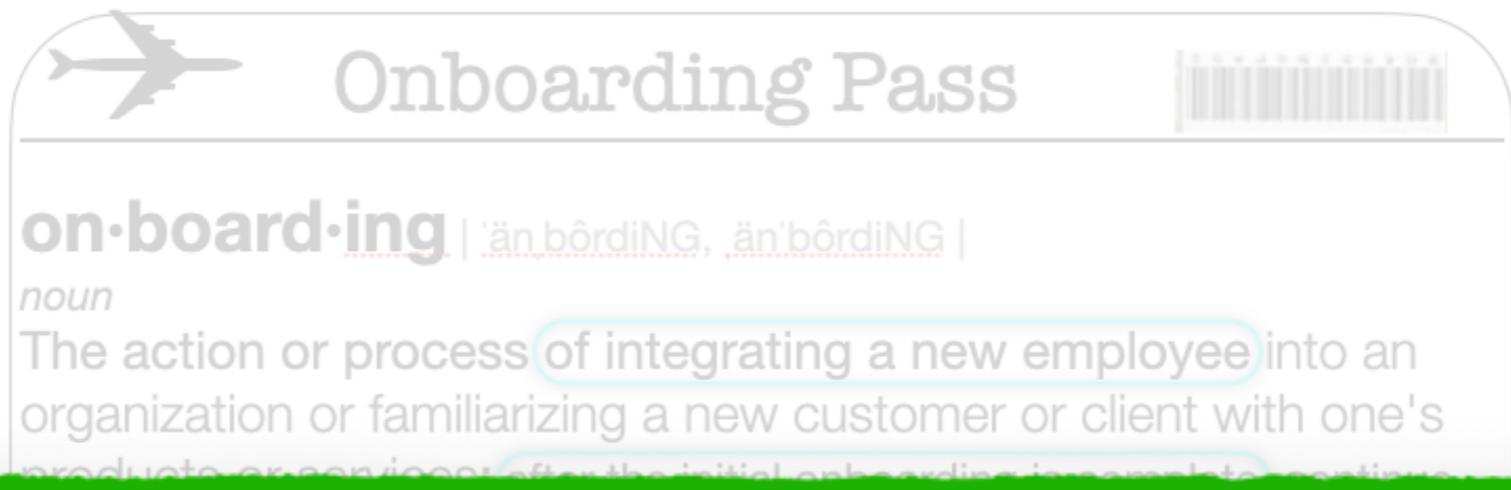
<https://languages.oup.com/google-dictionary-en/>

Onboarding Program: A Socio-Technical Adaptation of New Contributors to a Software Community.

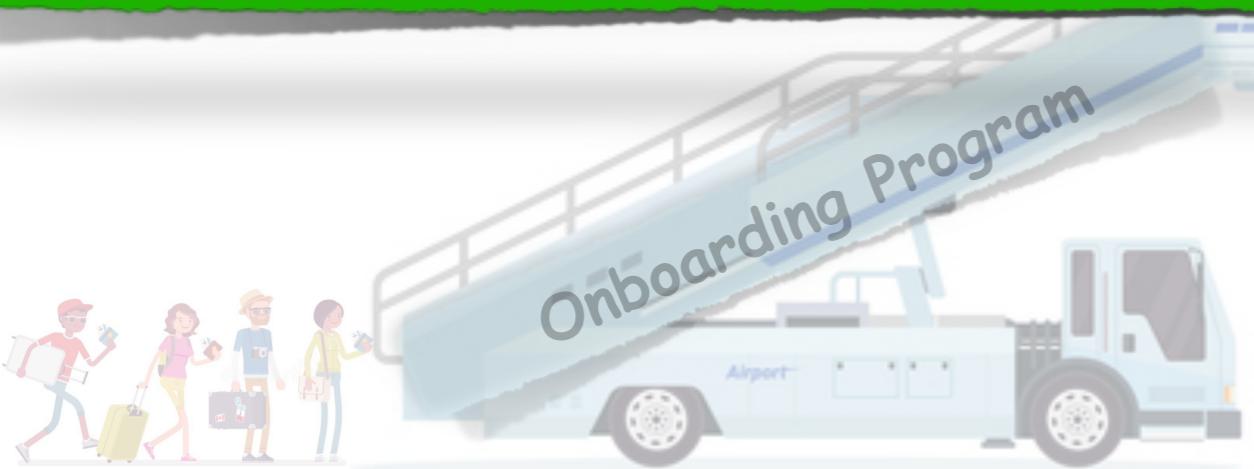


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Onboarding Program: A Socio-Technical Adaptation of New Contributors to a Software Community.



Thus far, all research was on onboarding in individual projects, what about SECOs?



<https://languages.oup.com/google-dictionary-en/>

SECO-Level Onboarding Involves Two Phases

Phase 1



SECO-Level: In-person Event

Our Paper: <https://2021.msrconf.org/profile/armstrongfoundjem1>

SECO-Level Onboarding Involves Two Phases

Phase 1



SECO-Level: In-person Event

Phase 2



Project-Level: Remote One-One Mentoring

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Our Goal: To Understand the Process and Impacts of Onboarding Program in Open-source SECOs



Phase 1 Observation of 72 SECO-level onboarding event participants:
To identify the **activities, challenges and perceived benefits** of SECO onboarding on new Contributors.

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To validate the **perceived benefits** in terms of contributors' **diversity, productivity**, and **quality**.

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Extracting Rich Set of Qualitative Data

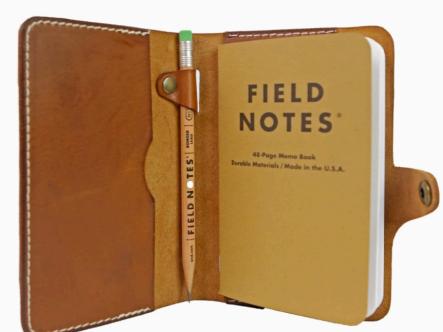


Theoretical knowledge

- 1. Hit or exceed the 75-day minimum initial training
- 2. Introduce the team to your business
- 3. Stress the significance of schedule adherence
- 4. Emphasize the importance of etiquette and customer relationships
- 5. Encourage resourcefulness



Day 1



Extracting Rich Set of Qualitative Data



Hands-on sessions

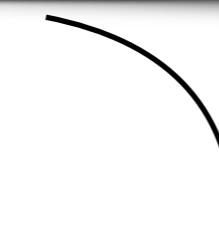
Day 2



<https://images.app.goo.gl/NzvJzjFLDNvKmPx9>

Identification of 43 Main Themes From the Audio-Visual Data

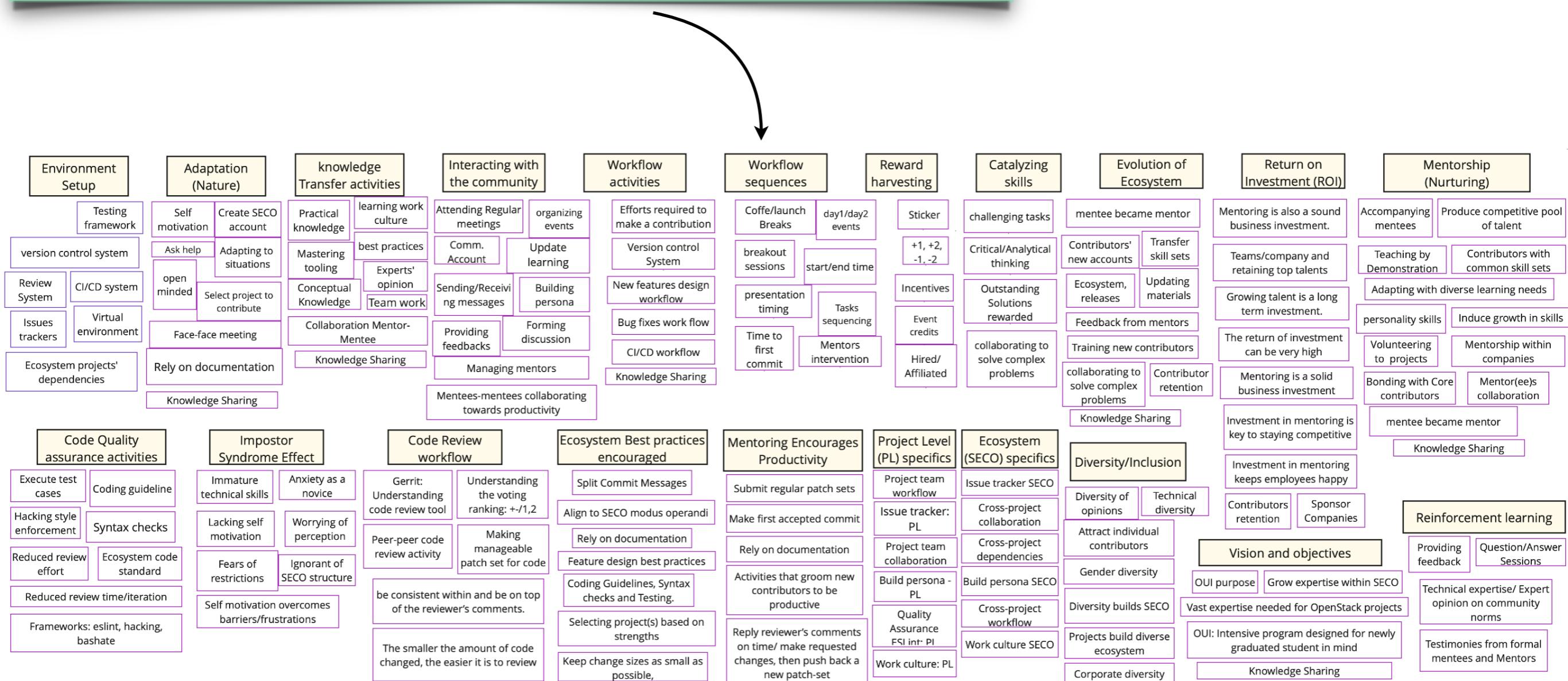
Categorizing codes/themes using an Affinity diagram



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Identification of 43 Main Themes From the Audio-Visual Data

Categorizing codes/themes using an Affinity diagram



Separate Themes under different Categories

Three Categories Emerged From the 43 Main Themes

22

Teaching Content/
Strategies

13

Onboarding
Challenges

8

Onboarding
Benefits

Category #1: Teaching Content Strategies

22

Teaching Content/
Strategies

Conceptual Knowledge (7)

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Example Codes:

... SECO processes and tools concepts

Category #1: Teaching Content Strategies

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Teaching Content/
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Conceptual Knowledge (7)

Practical Knowledge (7)

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Example Codes:

... SECO processes and tools concepts

... Code quality assurance activities

Category #1: Teaching Content Strategies

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Teaching Content/
Strategies

Conceptual Knowledge (7)

Practical Knowledge (7)

Strategies (8)

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Benefits

Example Codes:

... SECO processes and tools concepts

... Code quality assurance activities

... Adaptive teaching strategies

Category #2: Onboarding Challenges for SECO, Companies and Contributors

22

Teaching Content/
Strategies

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Onboarding
Benefits

... Vast Expertise needed for SECO projects

... Mentorship sustainability

... Soundness of Return on Investment

Category #3: Onboarding Benefits for SECO, Companies and Contributors

22

Teaching Content/
Strategies

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Onboarding
Challenges

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Onboarding
Benefits

Mentoring Enhances Diversity and Inclusion

Mentoring Enhances Productivity

Mentoring Enhances SECO Best Practices and Quality assurance

We provide quantitative evidences to three Most Discussed benefits

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Teaching Content/
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Onboarding
Benefits

Mentoring Enhances Diversity and Inclusion

Mentoring Enhances Productivity

Mentoring Enhances SECO Best Practices and Quality assurance

Our Goal: To Understand the Process and Impacts of Onboarding Program in Open-source SECOs

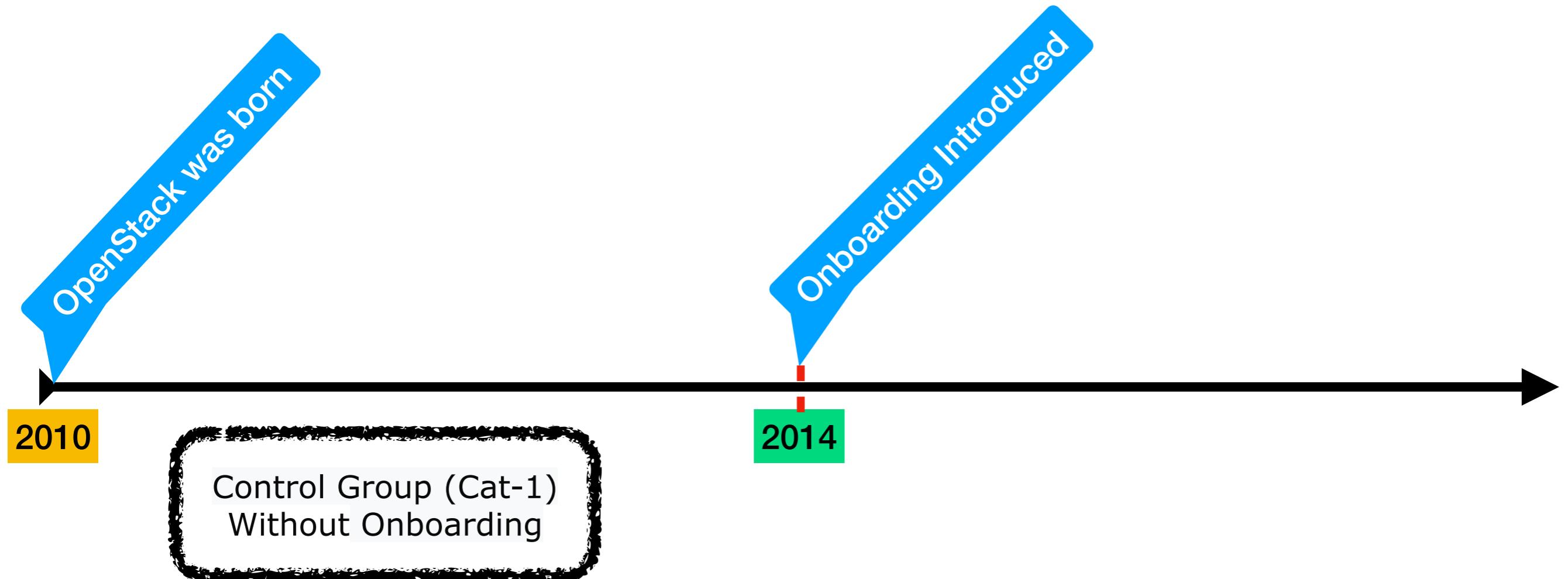


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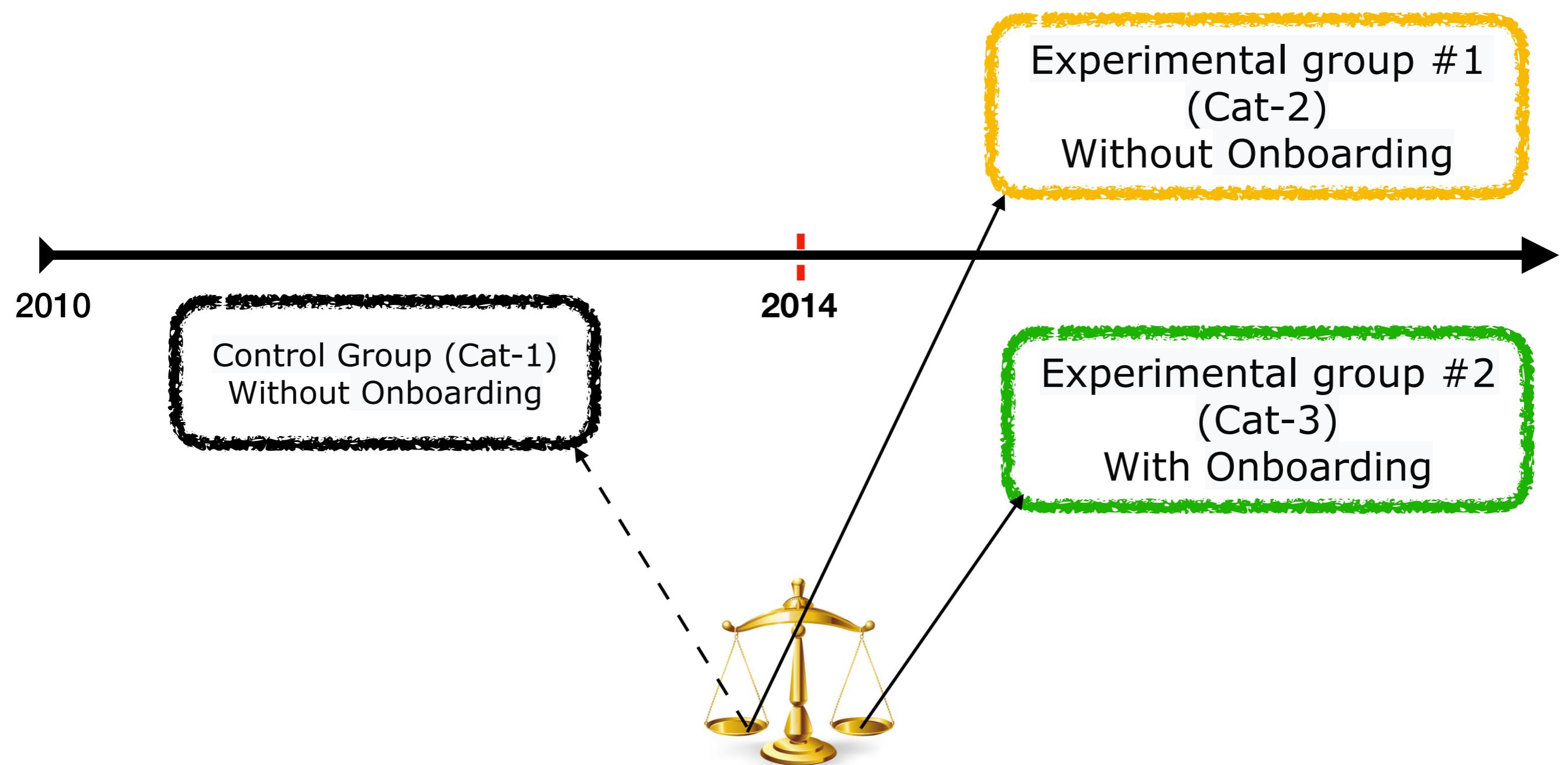
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Quantitative Data Set: 3-year of Development data of 1281 Contributors

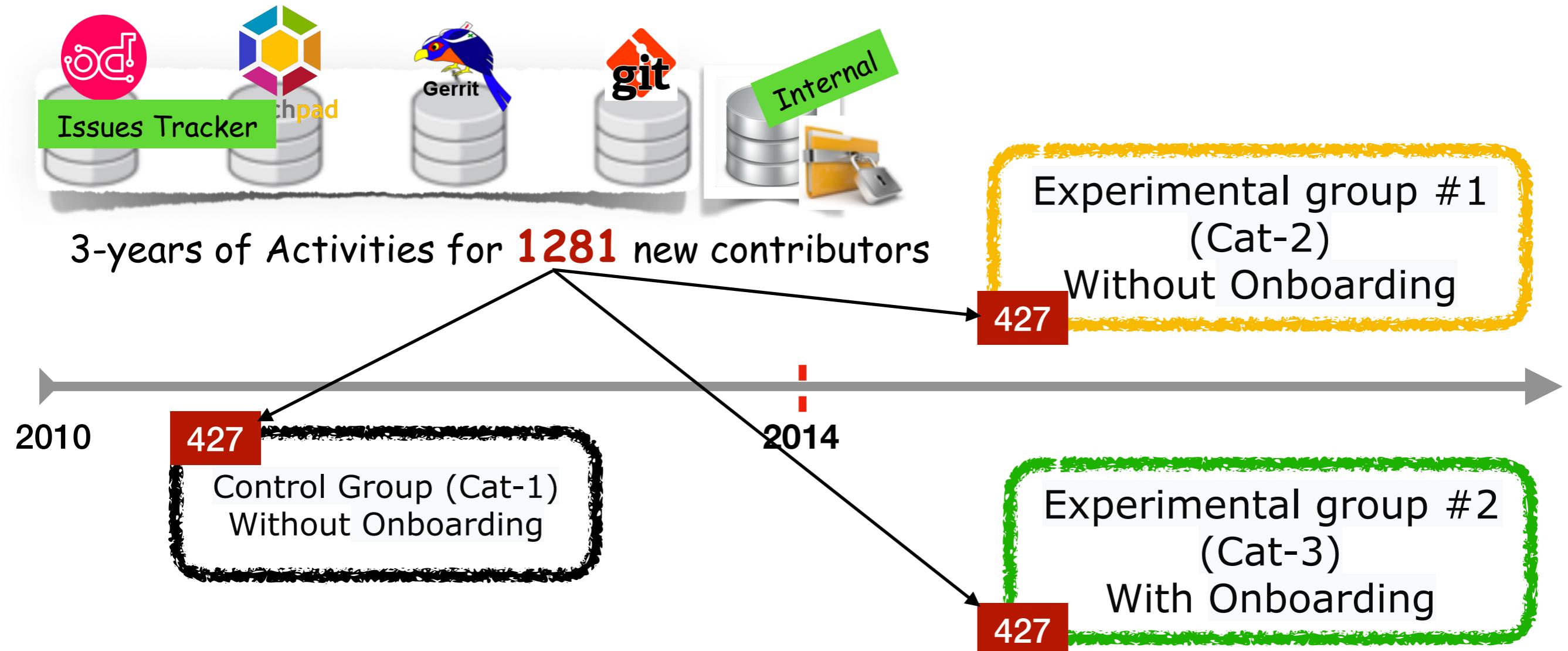


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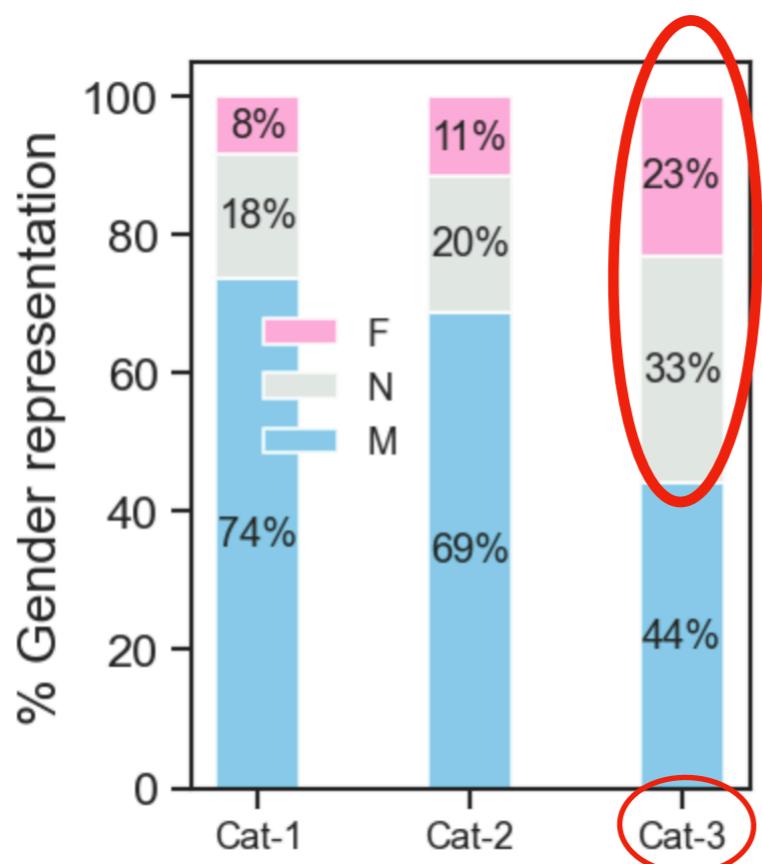


Quantitative Data Set: 3-year of Development data of 1281 Contributors



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65% more gender diversity in Cat-3



**Cat-3 Female & non-binary 65% higher
Compared to Cat-2**

Internal Datasets

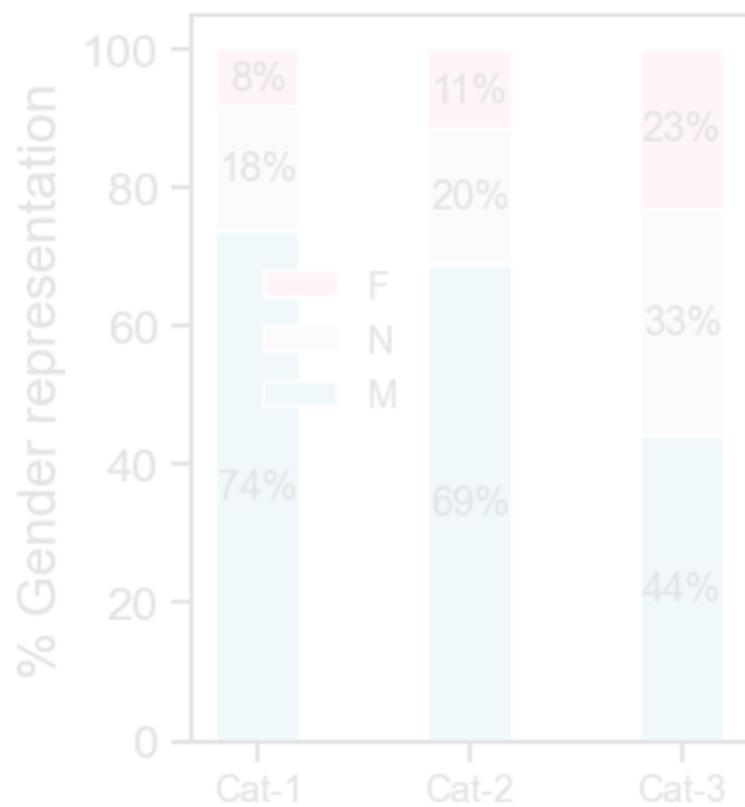


2: Median days-to-hire for Cat-3 is 33.0 vs. 212.0 days for Cat-2



3: Cat-3 (84.6% \geq 3 projects), while Cat-2 (82.7% = 1 project)

Cat-3 Contributors get Hired more Quickly by SECO Companies



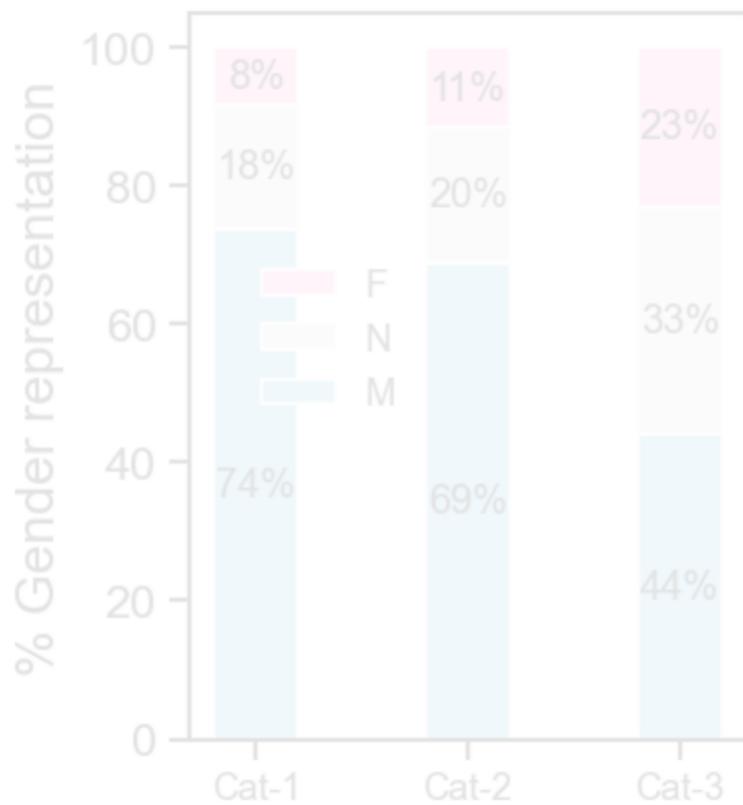
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Onboarded Contributors are Active in more Projects



1: Cat-3 Female & non-binary 65%
Compared to Cat-2

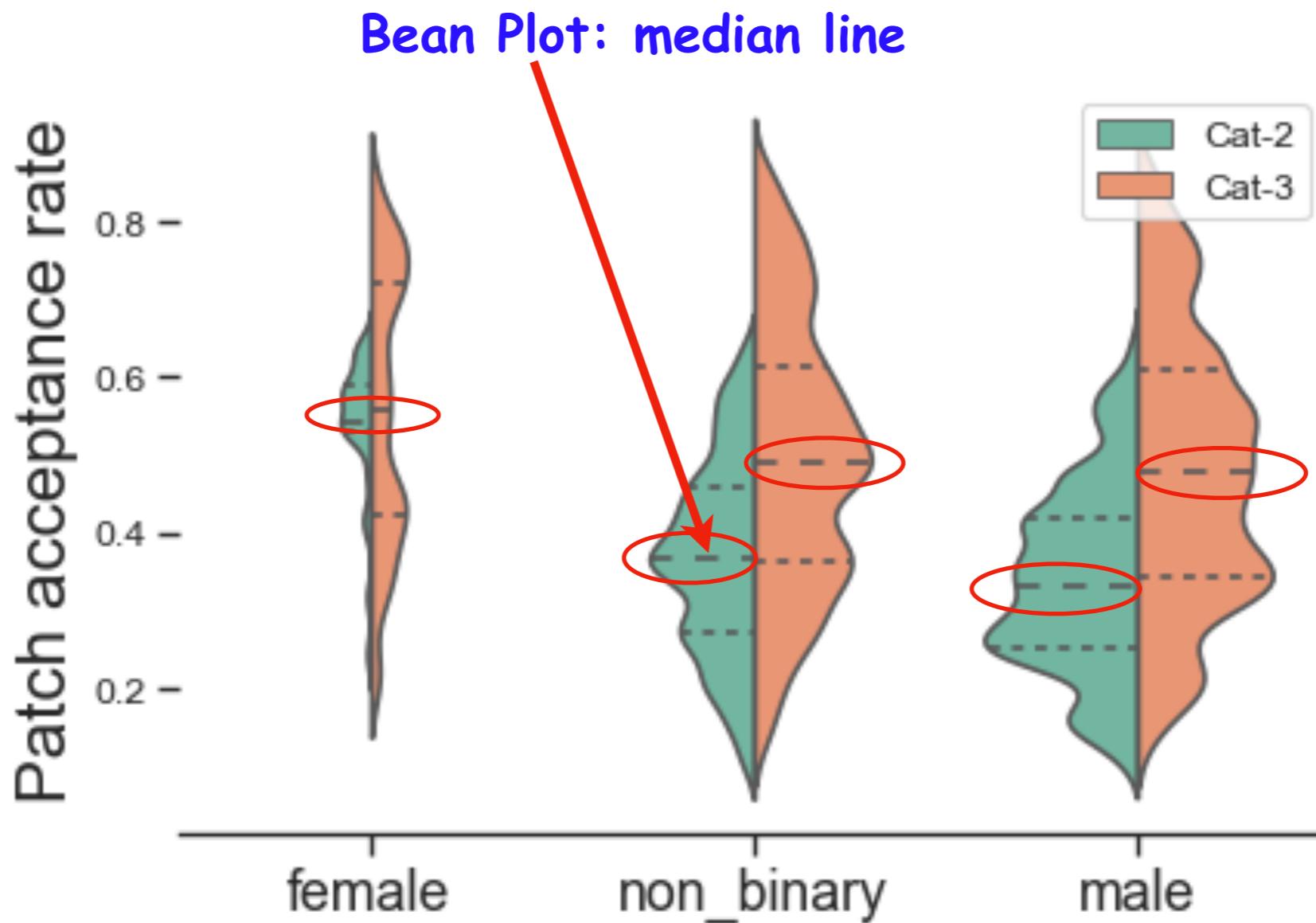
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Onboarded Participants have higher Patch Acceptance Rate (PAR)

$$\text{PAR} = \frac{\#\text{Accepted_PRs}}{\#\text{Submitted_PRs}}$$



Cat-3 contributors saw an increase in terms of PAR.

In both Categories, females outperformed the other genders with large effect size.

Onboarded Contributors Contribute More Quickly, and Stay Longer

Retention Rate

Onboarding correlates with a 16% longer average retention rate.

Time-to-First Commit (TFC)

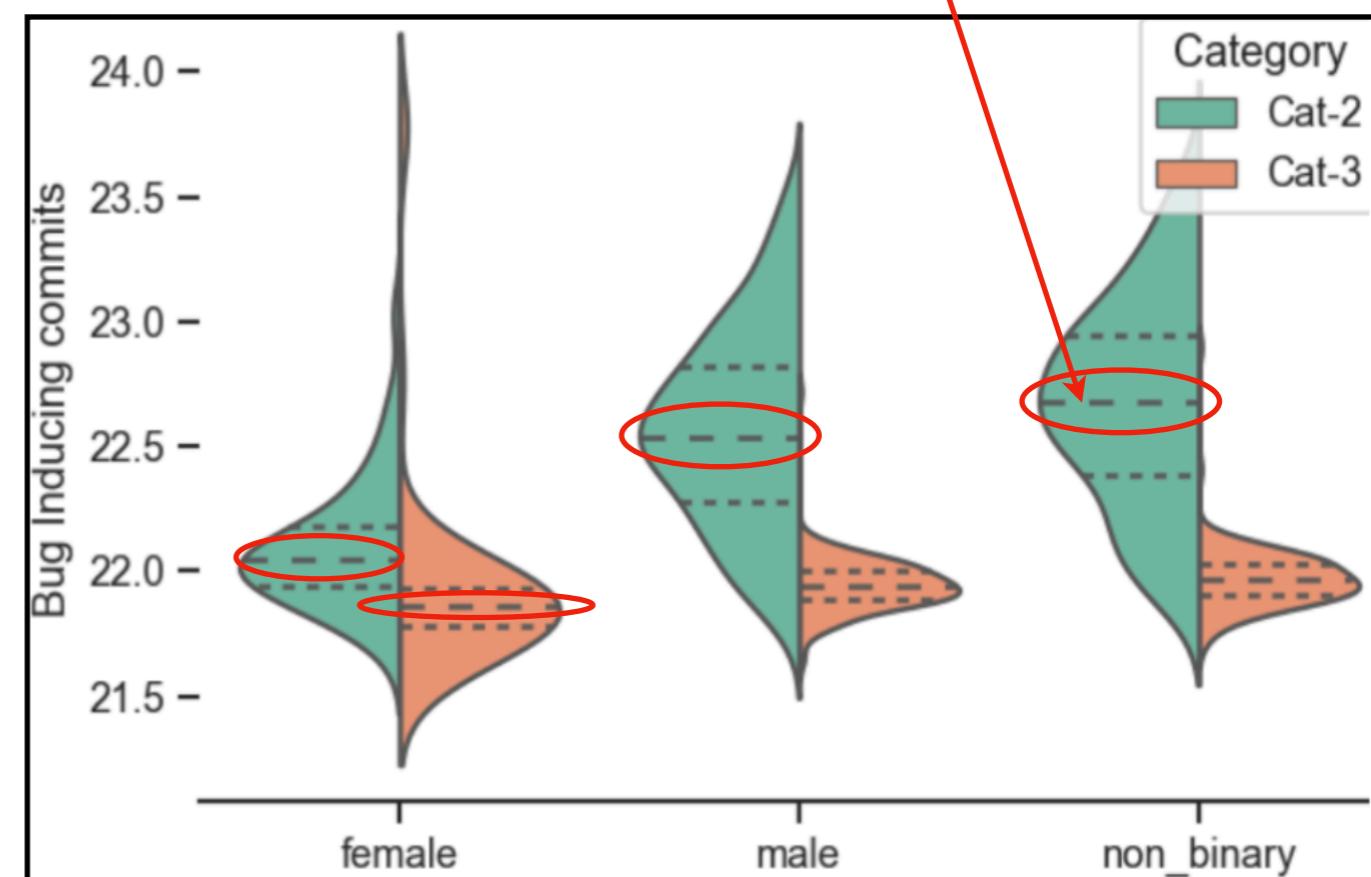
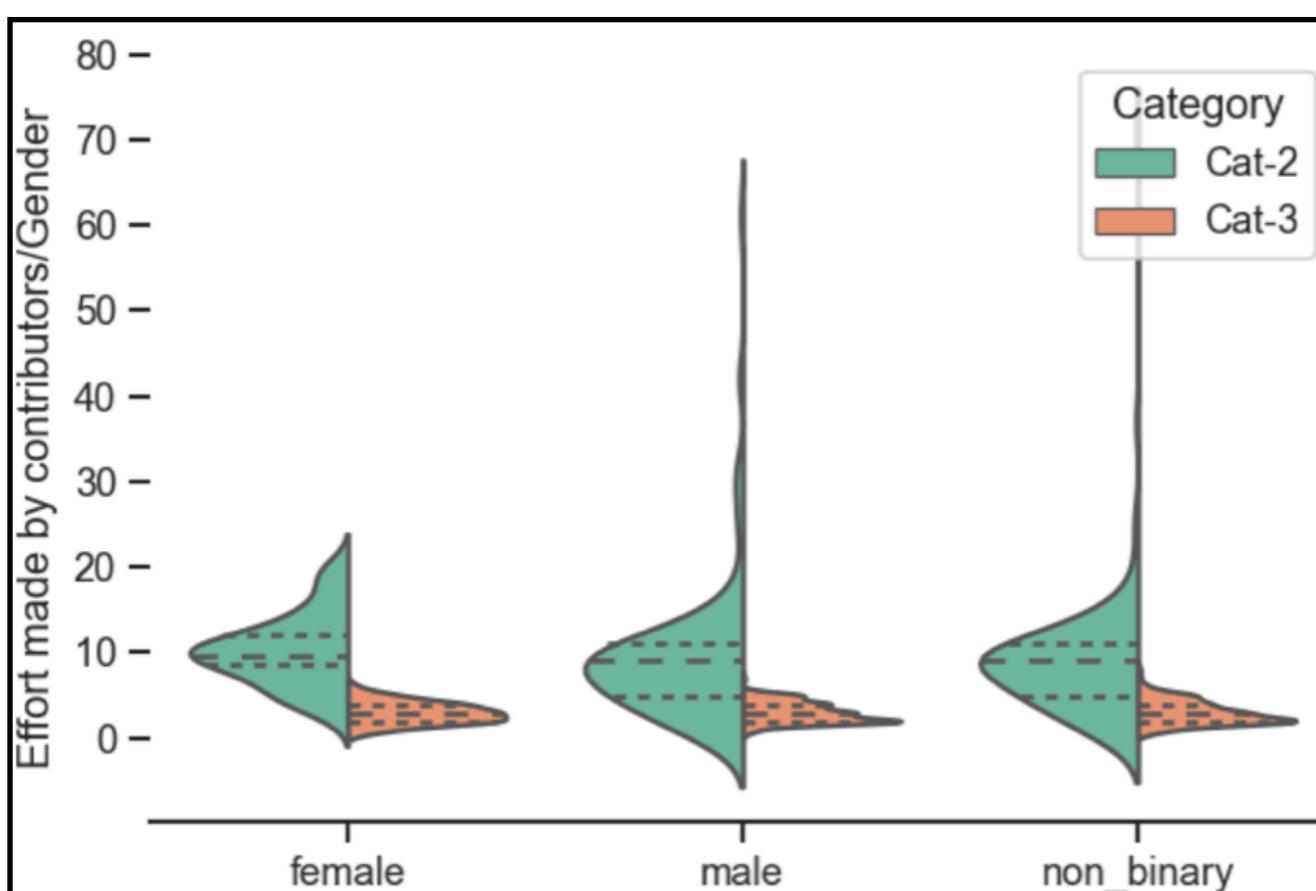


Onboarding correlates with a median 45% (Female) or 35% (male/non-binary) lower TFC.

Onboarded Contributors Require Less Attempts to make High Quality Code Changes

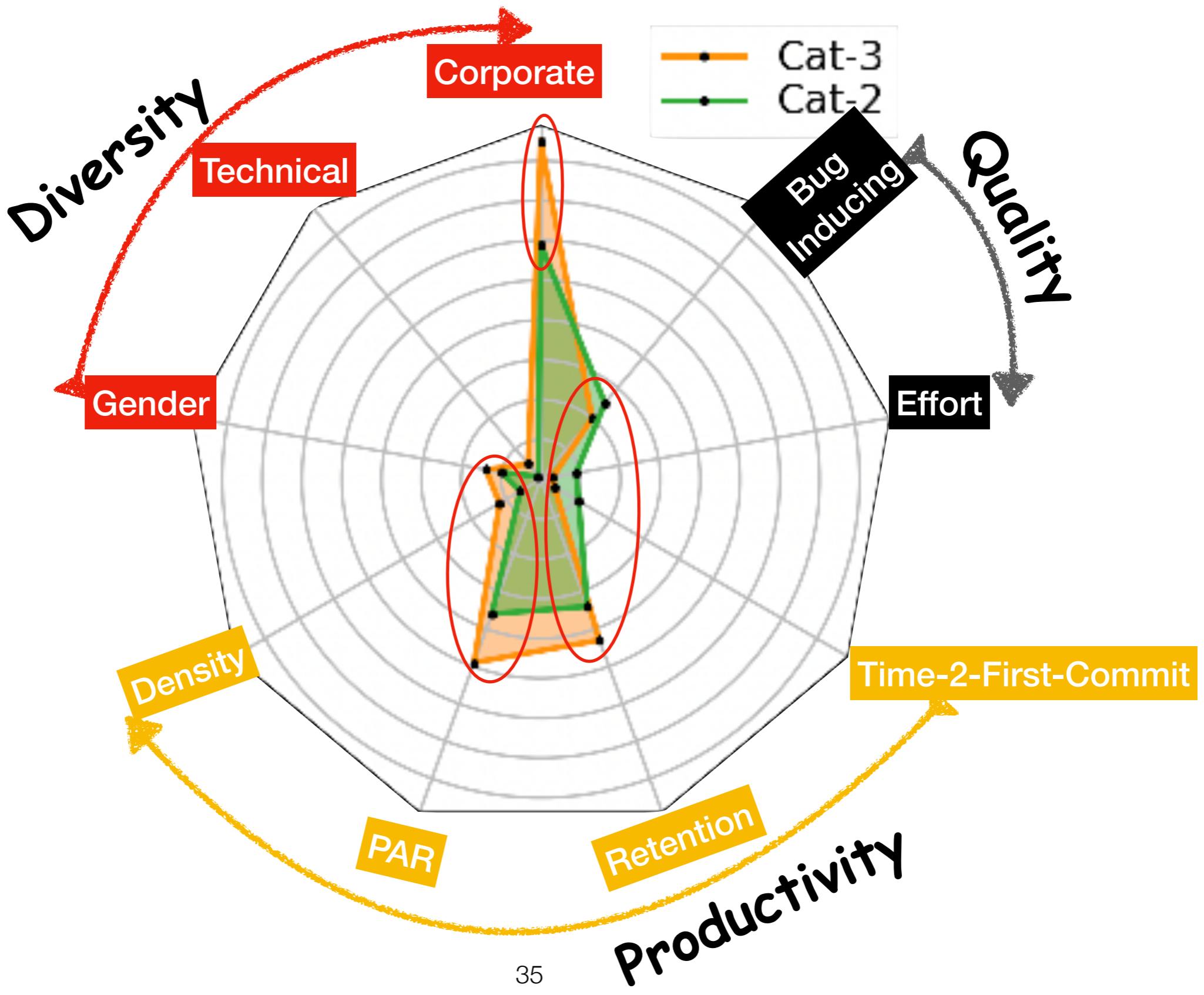
Effort: Onboarded contributors require less attempts to get their commits accepted.

Bean Plot: median line

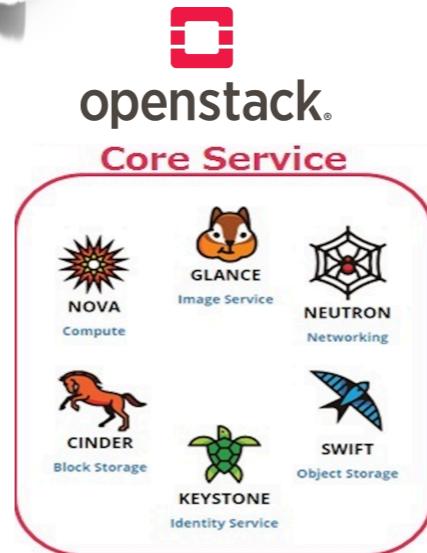


Bug Inducing commits: Onboarded contributors make less bug inducing commits (14%).

Onboarding Correlates With Higher Productivity, Diversity and Quality

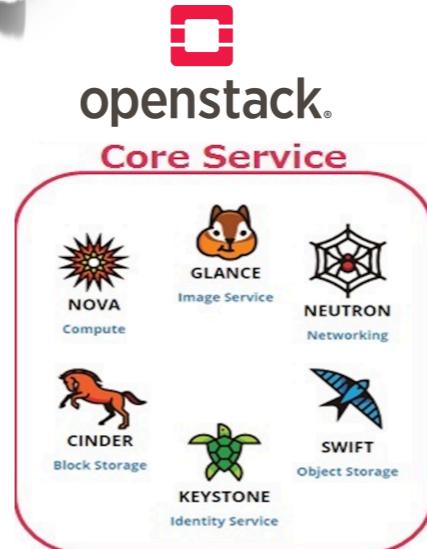


In Sum



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In Sum



Observational Study

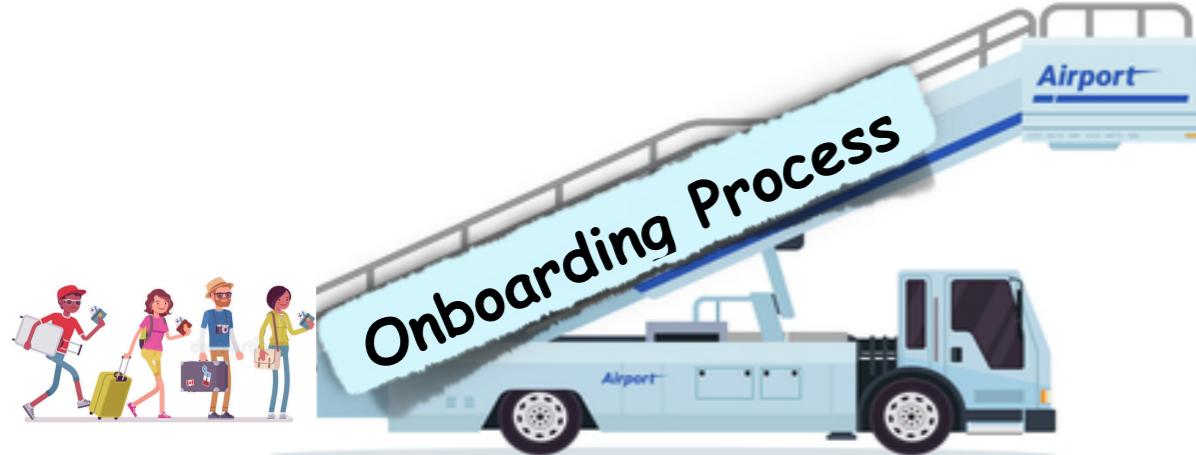
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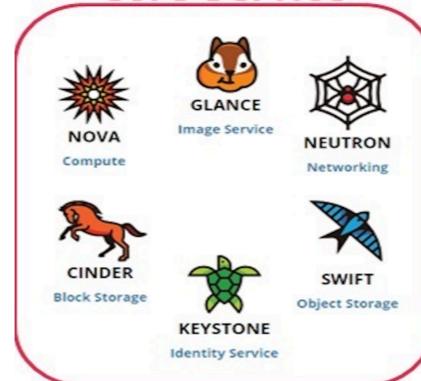
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In Sum



openstack.[®]
Core Service

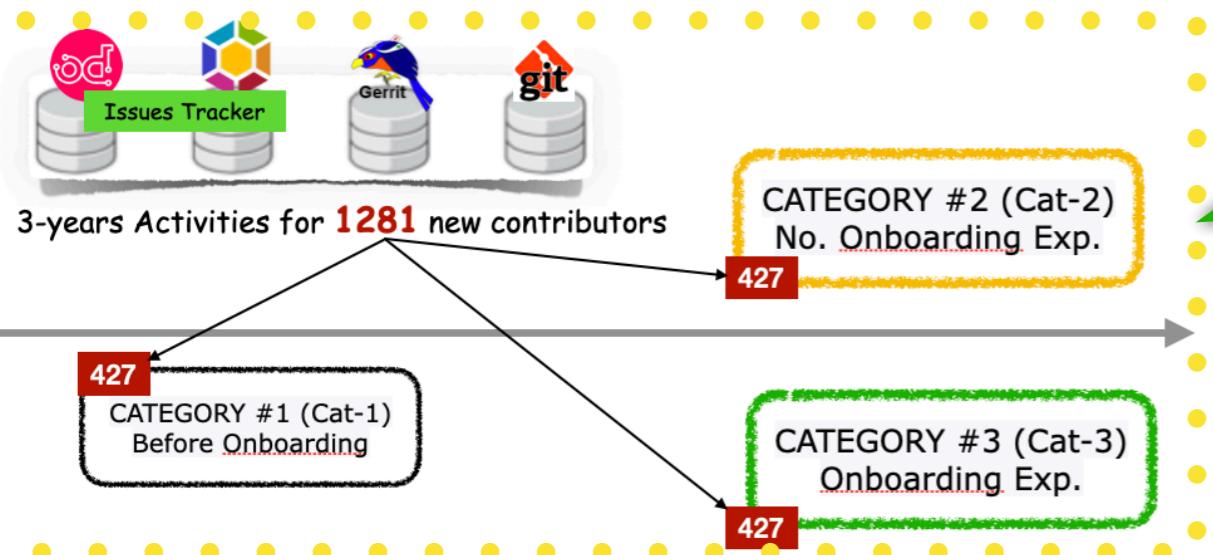


Observational Study

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Q/A?

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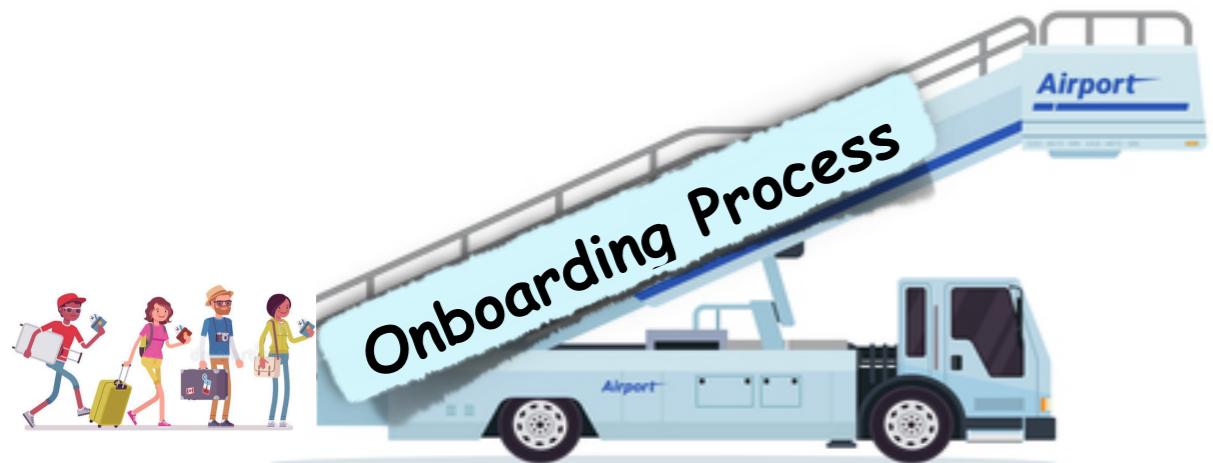
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openstack.

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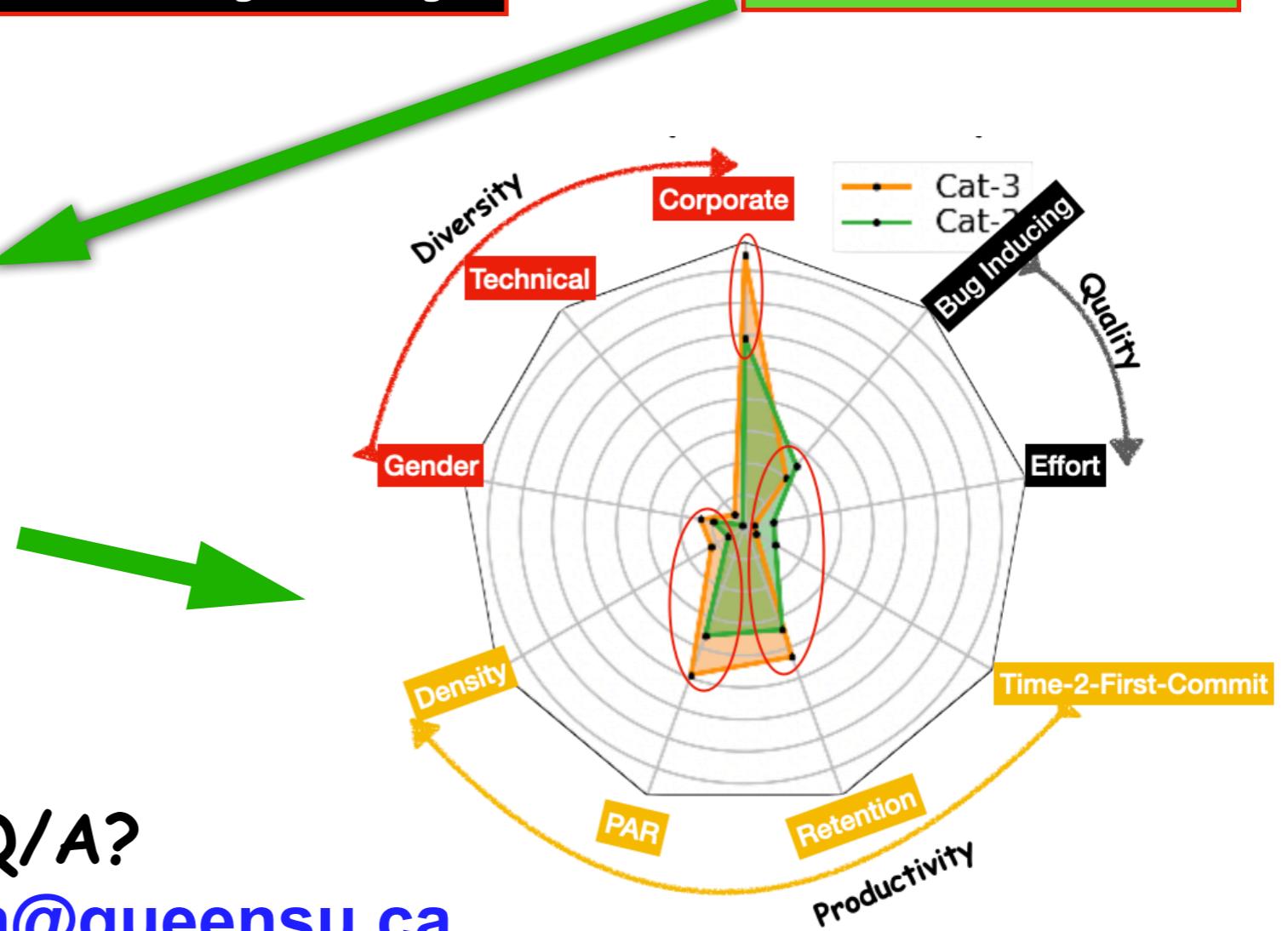
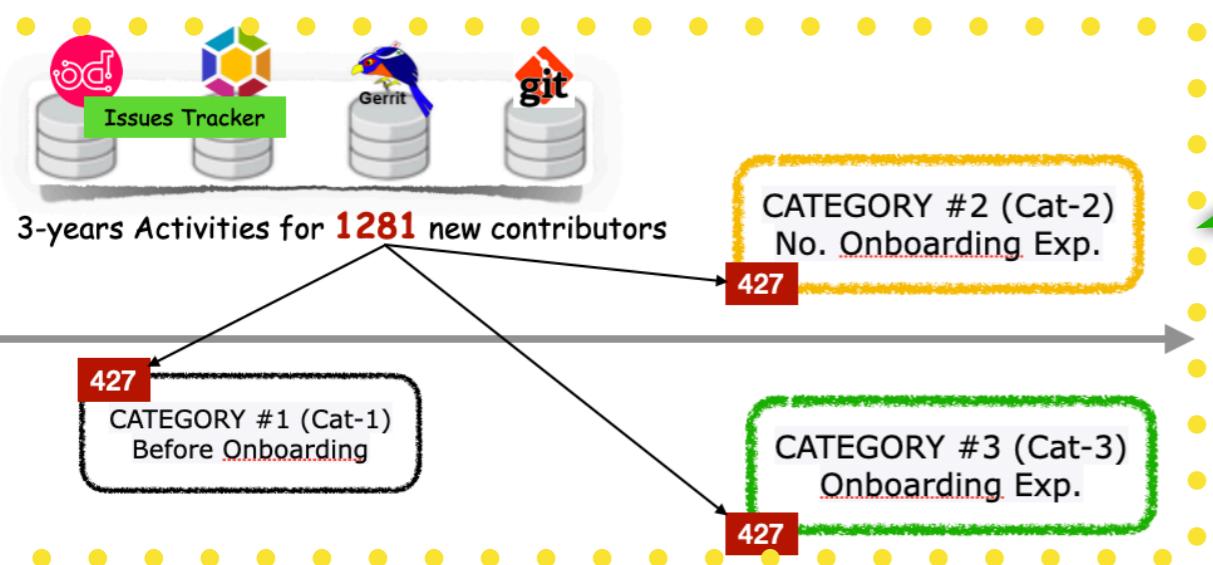


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