

Subject: Study on Cluster-Renames in XYZ  
From: XYZ  
To: john.doe@example.com  
Attachments: weekly\_rename\_activity.png, rename\_activity\_heatmap.png

Hello John,

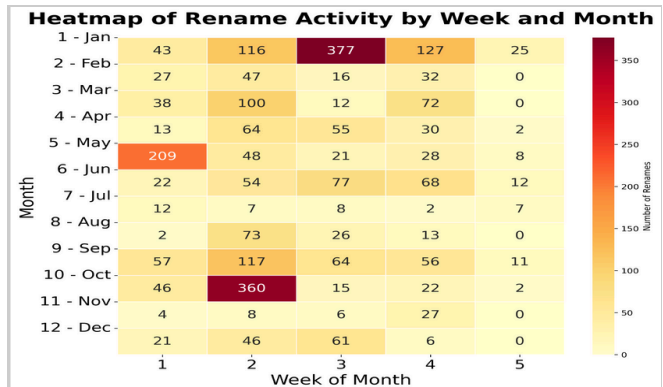
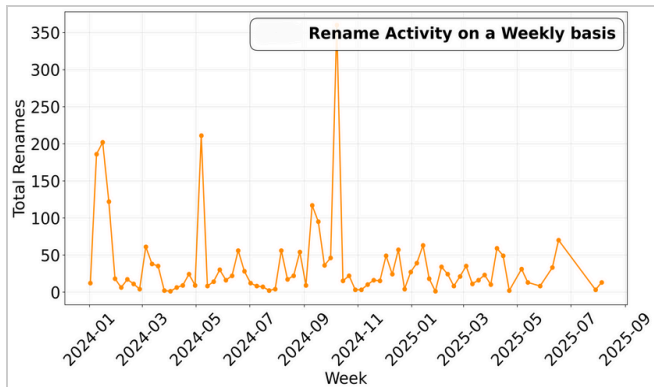
We are researchers from the University ABC, conducting a study to understand patterns and challenges in **cluster-renames**—situations where **multiple related program elements are renamed together in the same commit**.

**Our goal is to learn how developers approach these cluster-renames and whether parts of this process can be supported or automated through better tools.**

We analyzed the **500** most recent commits in **XYZ** and identified **120** commits that involved renaming. Among these rename commits, **20 commits (16.7%)** contained cluster-rename instances. For these cluster-rename commits, we further analyzed the number of renamed entities per commit and found the following distribution:

- Mean: **3.4** renames per commit
- Median: **3** renames per commit
- Maximum: **12** renames in a single commit

The figures below show an overview of cluster-rename activity in **XYZ** on a weekly basis:



We are reaching out to you because you are one of the most active contributors in commits with high cluster-rename activity. **John**, you renamed **58 entities across 7 commits**.

We would be grateful if you could help answer a few questions about your recent commit that contains **4** renames grouped into multiple clusters:

<https://github.com/example/project/commit/123abc>:

- Class *PaymentService* -> *BillingService*.
- Method *processPayment* -> *processBilling*.

- Field *paymentStatus* -> *billingStatus*.
- Variable *paymentList* -> *billingList*.

We refer to all of these renames as cluster renames. Below, we ask questions about this cluster rename.

- **Q1.** How long did it take you to identify the **4** related program elements (e.g., fields, classes, enums) that form a concept / cluster and should be renamed together as part of this cluster-rename?
- **Q2.** Was this cluster-rename challenging to perform or review? For example, identifying which program elements (fields, methods, classes, variables, etc) should change together, etc. What are some other challenges?
- **Q3.** Was this cluster-rename performed manually or using automated tools (or both)? Would it be helpful to have tools that assist in automatically identifying such related program elements and renaming the whole cluster in one step, rather than renaming them individually?

Your responses will remain **anonymous** and will be used solely for research purposes. We sincerely appreciate your time and contribution. If you're interested in the results of our study, let us know, and we'll be happy to share them with you once the research is complete.

If you have any additional thoughts or experiences related to cluster-renaming or refactoring in large codebases, we'd love to hear them as well.

Warm regards,

XYZ

Ph.D. Student

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