

# Appendix to A Field Study of Refactoring Rationale, Benefits, and Challenges at Microsoft

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## Appendix to A Field Study of Refactoring Rationale, Benefits, and Challenges at Microsoft

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**Abstract:** In order to understand refactoring practices at Microsoft, we sent a survey to 1290 engineers, whose change comments include a keyword, “refactoring” in the last 2 years for the five Microsoft products (Windows Phone, Exchange, Windows, Office Communication and Services, and Office). We purposely targeted the engineers who are already familiar with the term, “refactoring,” because our goal is to understand their own refactoring definition and their perception about the value of refactoring. This document contains the complete set of survey questions. The results of the survey will be published in a separate paper.

### Survey on Refactoring Practices at Microsoft

We are researchers in the Empirical Software Engineering (ESE) group at Microsoft Research who are interested in understanding refactoring practices and building recommendations for better refactoring practices and tool support. We would appreciate your feedback via this 15-minute survey, since it can help us refine our hypotheses and develop better recommendations.

*This survey is anonymous.*

1.	What division do you primarily work in? <ul style="list-style-type: none"><li>• Entertainment and Devices Division</li><li>• Microsoft Business Division</li><li>• Online Services Division</li><li>• Server &amp; Tools Division</li><li>• Windows and Windows Live Division</li><li>• Other</li></ul>
2.	Which best describes your primary work area? <ul style="list-style-type: none"><li>• Development</li><li>• Test</li><li>• PM</li><li>• Build</li><li>• Design and UX</li><li>• Documentation</li><li>• Other</li></ul>
3.	How many years have you worked at Microsoft? (decimals okay) (Min Number: 0 - Max Number: 37)

4.	How many years have you worked in the software industry? (decimals okay) (Min Number: 0 - Max Number: 80)
5.	Which of the following programming languages are you familiar with? (Check at least 1 but no more than 4) <ul style="list-style-type: none"><li>• C#</li><li>• C++</li><li>• C</li><li>• Java</li></ul>
6.	How do you define "refactoring"? (Max Characters: 2000)
7.	Do you perform refactorings <b>ONLY</b> in the MQ milestone? <ul style="list-style-type: none"><li>• Not applicable</li><li>• Yes</li><li>• No</li></ul>
8.	How often do you perform refactoring? <ul style="list-style-type: none"><li>• daily</li><li>• weekly</li><li>• monthly</li><li>• yearly</li><li>• seldom</li><li>• never</li></ul>
9.	How many hours per month roughly do you spend on refactoring? (Min Number: 0 - Max Number: 160)
10.	In which situations do you perform refactorings? (Max Characters: 2000)
11.	Which keywords do you use or have you seen being used to mark refactoring activities in change commit messages? Please list as many as possible. (Max Characters: 2000)
12.	What tools do you use during refactoring? (Max Characters: 2000)
13.	What percentage of your refactoring is done manually as opposed to using automated refactoring tools? (Min Number: 0 - Max Number: 100)

14. How strongly do you agree with each of the following statements?

	strongly agree	agree	neither agree or disagree	disagree	strongly disagree	no re- sponse
Refactoring improves program readability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring introduces subtle bugs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring breaks other people's code	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring improves performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring makes it easier to fix bugs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring helps avoiding changes that involve multiple modules.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring makes it hard to merge with other's changes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring reduces code duplication or repetitive edits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring makes it easier to add new features	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactored code is difficult to understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring reduces dependencies to other teams' code	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring helps improve documentation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactoring makes it easier to reuse existing functionality in a different context.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. What benefits have you observed from refactoring?

(Max Characters: 2000)

16. Based on your own experience, what are the risks involved in refactoring?

(Max Characters: 2000)

17. What are the challenges associated with performing refactorings at Microsoft?

(Max Characters: 2000)

18. How do you ensure a program correctness after refactoring?

(Max Characters: 2000)

19. How often do you perform the following activities after refactoring?

	always	sometimes	never	no response
Code review	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Successfully compile a program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Run unit tests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Run bug detectors such as "Prefast"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. The following lists some of the types of refactorings. Please indicate whether you know these refactorings or used them before.

	Usually do this both man- ually and using automated tools.	Usually do this manually	Usually do this using automated tools	Know this refactoring type but don't use it.	Don't know this refactoring type	No opinion
Rename	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extract Method	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encapsulate Field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extract Interface	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove Parameters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inline Method	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pull Members Up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Push Members Down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Replace Constructor with Factory Method	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use Base Type Wherever Possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reorder Parameters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. How does the abstraction level of refactorings in the previous question (such as "Extract Method" and "Use Base Type Wherever Possible") match the kinds of refactorings that you often perform?

(Max Characters: 2000)

22. How strongly do you agree with each of the following statements?

	strongly agree	agree	neither agree or disagree	disagree	strongly disagree	no opin- ion
I carry out refactorings in batch.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I interleave refactorings with other types of changes that modify external program behavior.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do most refactorings manually without using automated tools.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactorings supported by a tool differ from the kind of refactorings I perform manually	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refactorings that I apply are higher level changes than the ones supported by tools.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. If you would like to be informed about the results of this research, please enter your alias in the following box.

(Max Characters: 256)

- |     |  |
|-----|--|
| 24. | If you would be willing to participate in a follow-up interview (15 minutes) to share your perspective and anecdotes on refactoring at Microsoft, please enter your alias in the following box.<br>(Max Characters: 256) |
| 25. | If you have any other comments on this survey, please write them in the following text box.<br>(Max Characters: 2000)  |

Thank you for your feedback!