Prevalence of Botched Code Integrations

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Different Kinds of Integration Conflicts

Conflict			Merges?	Runs?	Correctly?
Textual	`-if (5 > x) {` `+if (5 == x) {`	`-if (5 > x) {` `+if (5 < x) {`	✖	✖	✖

Syntactic		`if (5 > x) {`
		`    return 10;`
		`}`
		`}`
			✔	✖	✖

Semantic	`+if (freezes(temp)) {`
	`+  ...`
	`+}`
		`def freezes(y) {`
		`-  return y < 0;`
		`+  return y < 100;`
		`}`
			✔	✔	✖

Mens, T. (2002). A State-of-the-Art Survey on Software Merging. IEEE Transactions on Software Engineering.
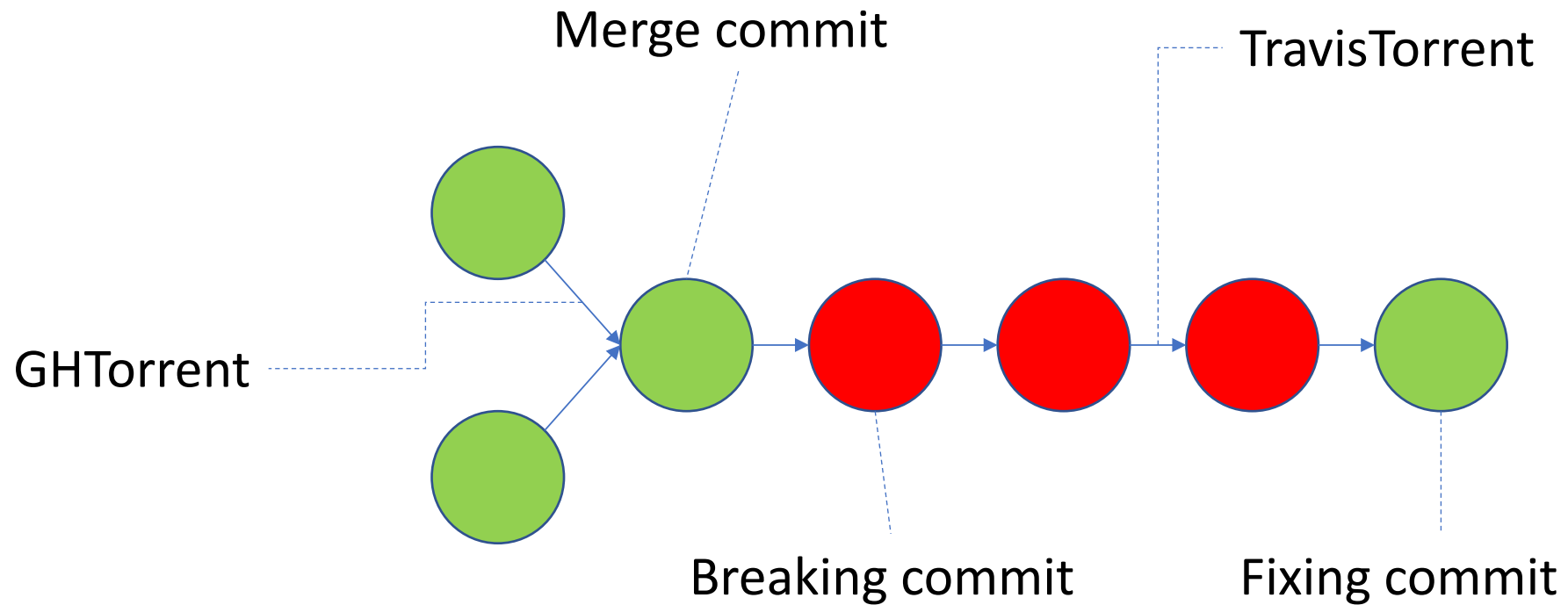
Research Questions

1. How often do code integrations lead to conflicts?

2. How much effort is needed to fix conflicts after code integration?

3. What type of files is this effort concentrated in?

Dataset
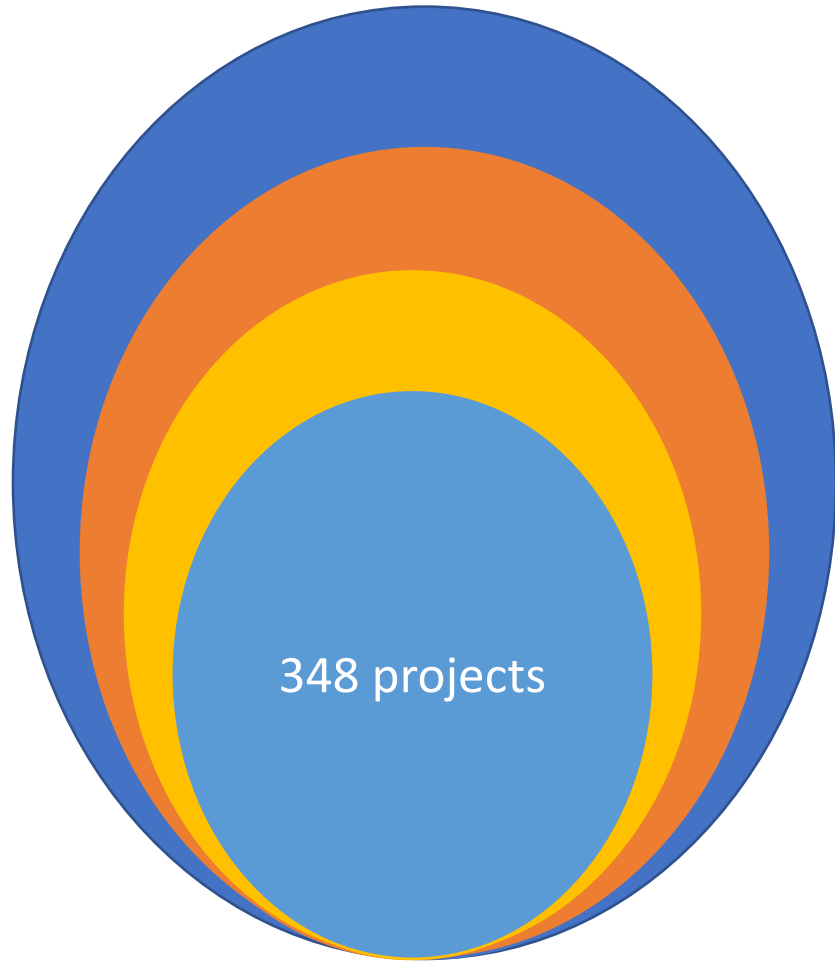
- TravisTorrent
- 50+ builds of merge commits
- Sufficient success rate
- Information on parents of 50+ merge commits
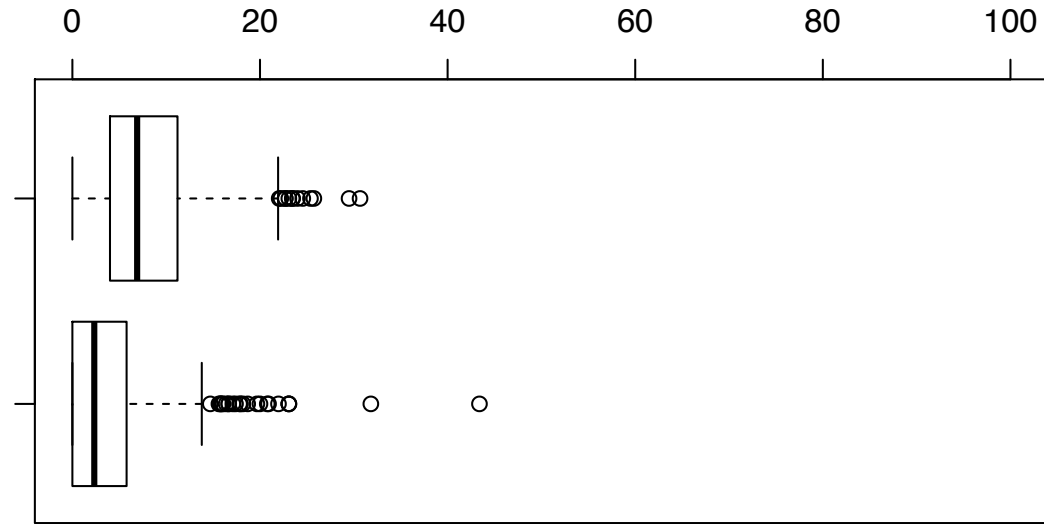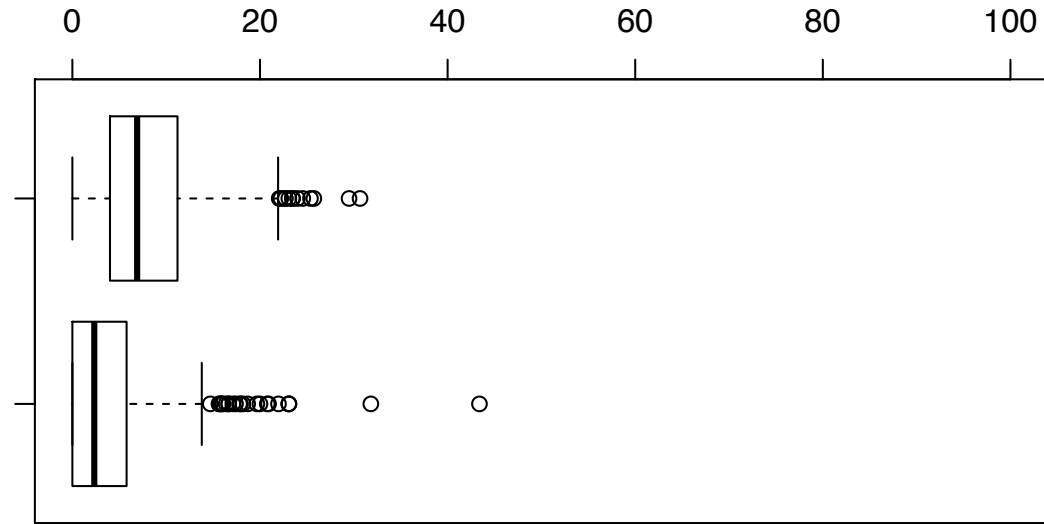
Research Method: Some Definitions

RQ1: How often do code integrations lead to conflicts?

Breaking merge commits occur less frequently than breaking regular commits.

$$\frac{Breaking\ regular\ commits}{All\ regular\ commits}$$

$$\frac{Breaking\ merge\ commits}{All\ merge\ commits}$$

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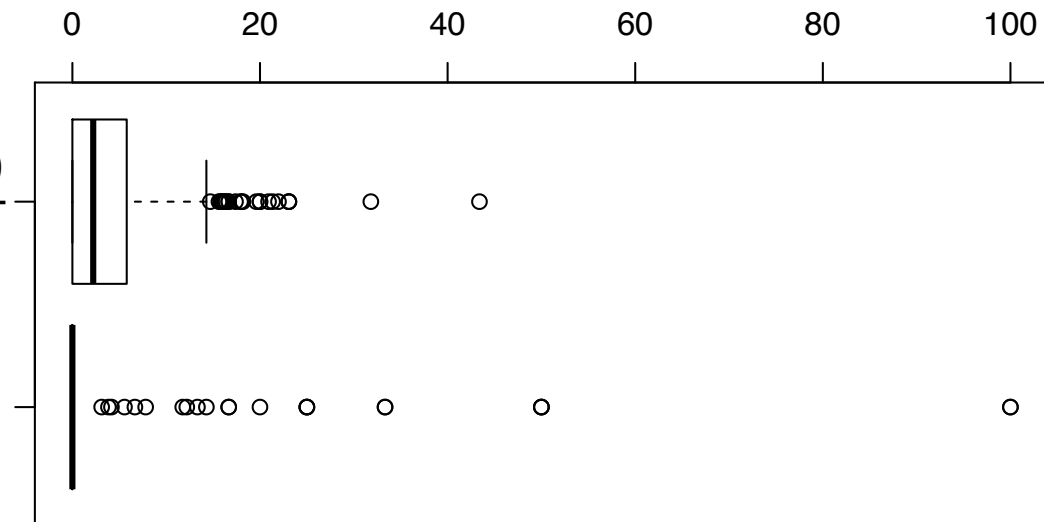
$$\frac{Breaking\ regular\ commits}{All\ regular\ commits}$$

$$\frac{Breaking\ merge\ commits}{All\ merge\ commits}$$

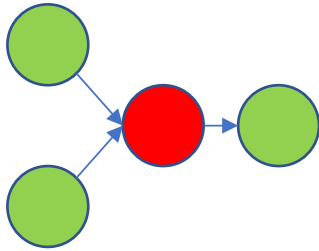$$\frac{Breaking\ (merge\ commits\ \wedge\ not\ pull\ request)}{All\ (merge\ commits\ \wedge\ not\ pull\ request)}$$

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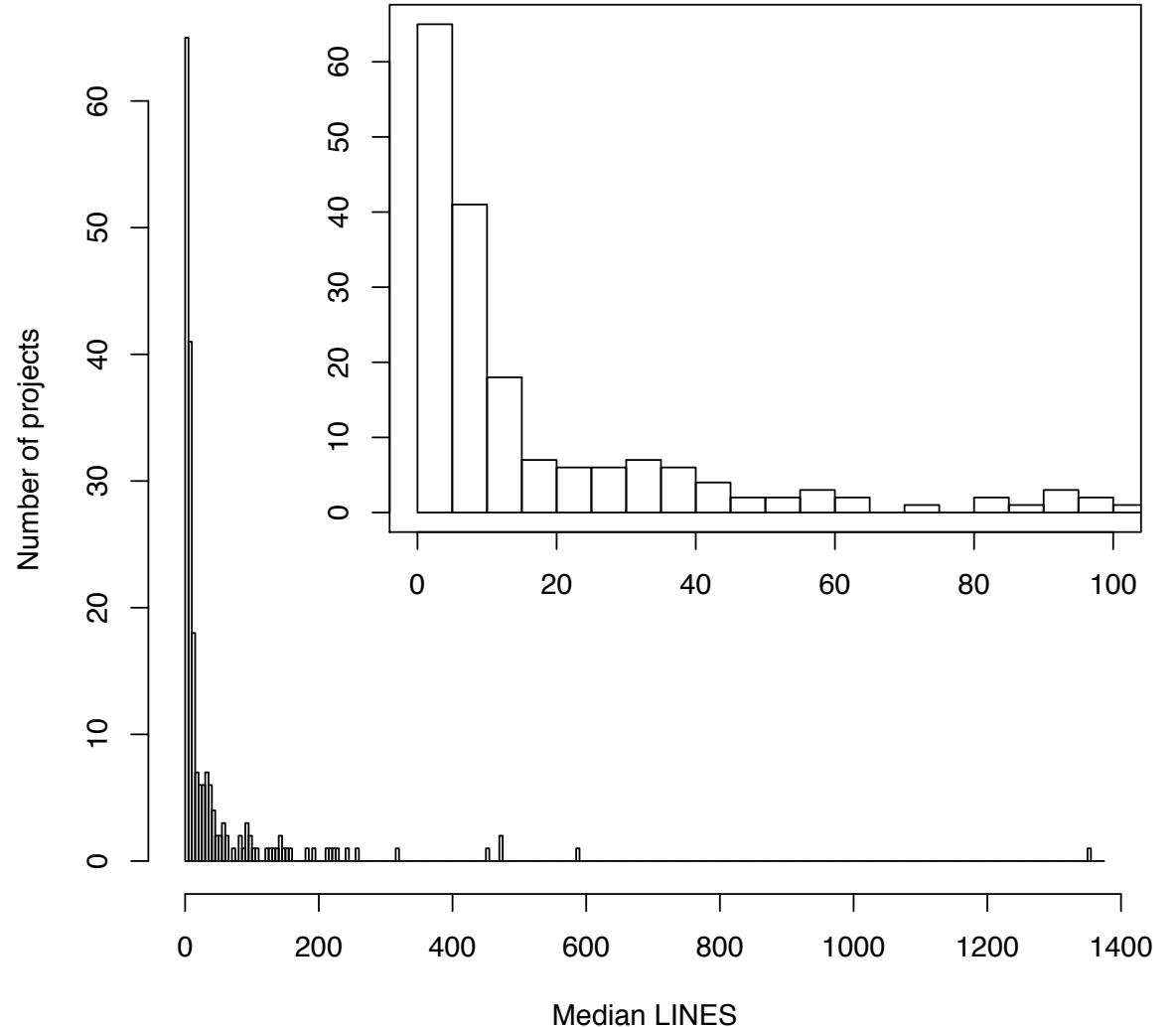
RQ2: How much effort is needed to fix conflicts after code integration?

- 87% of projects usually repair on next build
- 67% of projects usually repair the same day. 94% the same week.

Usually fixed with one build on the same day using less than ten lines of code.

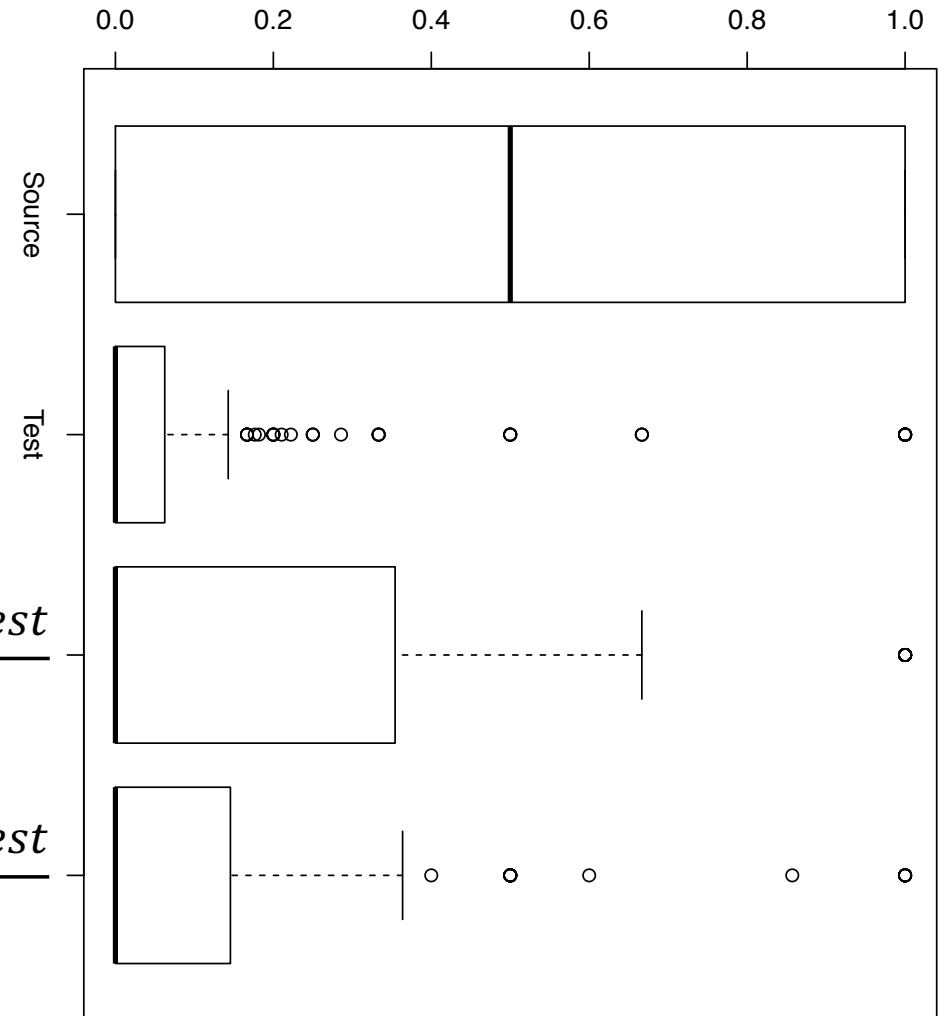# RQ3: What type of files is this effort concentrated in?

Breaking merge commits are fixed by changes to the source code.

$$\frac{Number\ of\ fixes\ in\ Source}{Number\ of\ fixes\ total}$$

$$\frac{Number\ of\ fixes\ in\ Test}{Number\ of\ fixes\ total}$$

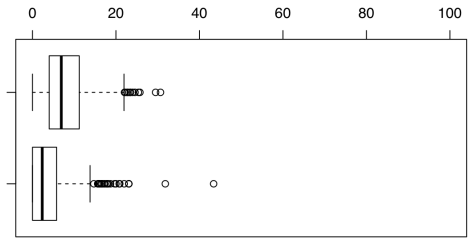$$\frac{Number\ of\ fixes\ in\ both\ Source\ and\ Test}{Number\ of\ fixes\ total}$$

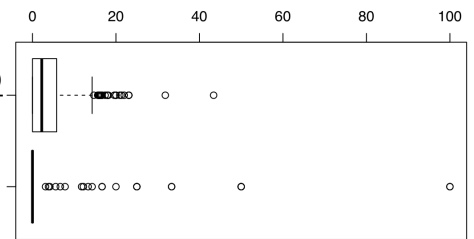$$\frac{Number\ of\ fixes\ in\ neither\ Source\ nor\ Test}{Number\ of\ fixes\ total}$$

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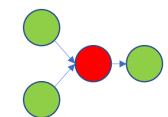Usually fixed with one build on the same day using less than ten lines of code.

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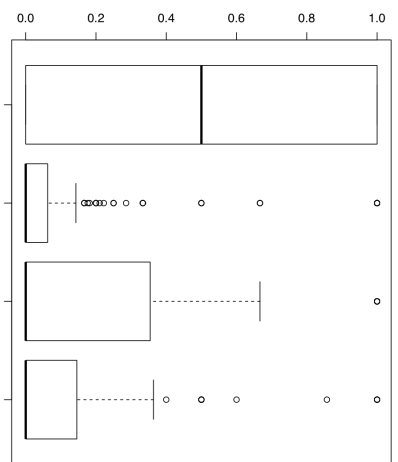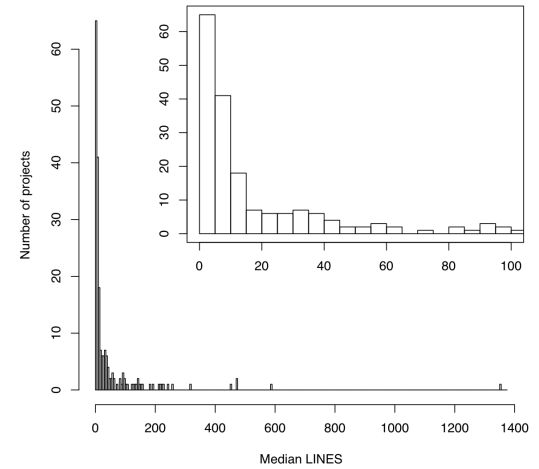
What Next?

- Improved categorisation of breaking merge commits
- Tool support for automatic prediction and detection of semantic merge conflicts