A Study of Bugs Found in the Puppet Configuration Management System

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1. Background

Studying the bugs of complex systems improves their understanding and informs research into automated bug detection and prevention.

- Puppet manages machines based on a central configuration.
- Puppet is widely adopted in the industry with users in Twitter, Uber, and the NYSE.
- This study fills the research gap in this space.

2. Research Questions

What are the most common features of bugs in Puppet?

1. Symptoms.
2. Root causes.
3. Impact.
4. Triggers.
5. System dependency.
6. Fixes.

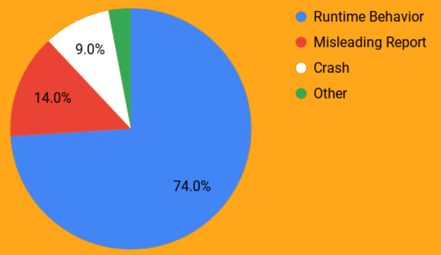
3. Methodology

1. Collected 10136 issue reports from Jira.
2. Collected 8906 pull requests and 34123 commits from Github.
3. Associated bug reports to fixes.
4. Analyzed a sample of 100 bugs [1].

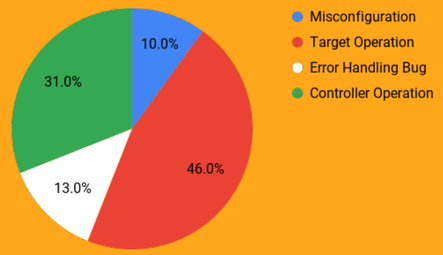
4. Results

The distribution of each category in the 100 bug sample.

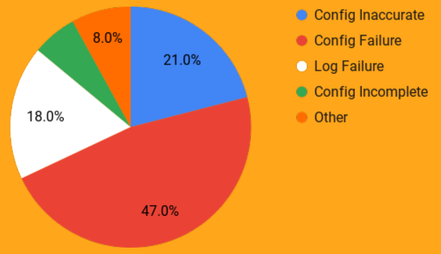
1. Symptoms



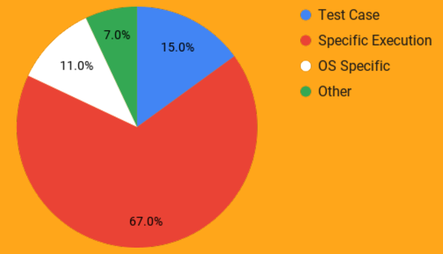
2. Root Causes



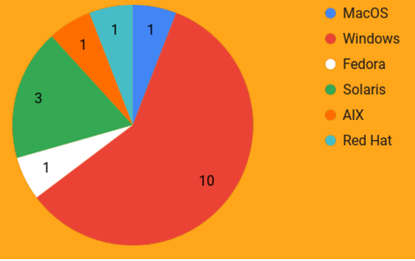
3. Impact Consequence



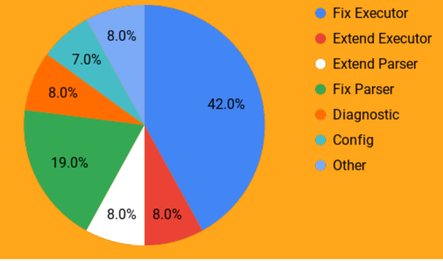
4. Trigger Reproduction



5. System Dependency



6. Conceptual Fix



5. Additional Contributions

Open-sourced and available for use.

- Artifacts and scripts.
- Data set of 2146 bugs with fixes.
- Bug study categorization tool.

6. Conclusions

- Applying automated bug detection methods like fuzz testing to the executor and parser would have the greatest return on investment.

7. Future Work

- Analyze a larger sample to solidify results.
- Research automated bug detection [2].

8. References

1. Chaliasos, S., Sotiropoulos, T., Drosos, G. P., Mitropoulos, C., Mitropoulos, D., & Spinellis, D. (2021). Well-typed programs can go wrong: a study of typing-related bugs in JVM compilers. Proceedings of the ACM on Programming Languages, 5(OOPSLA), 1–30. https://doi.org/10.1145/3485500
2. Sotiropoulos, T., Mitropoulos, D., & Spinellis, D. (2020). Practical fault detection in puppet programs. Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering. https://doi.org/10.1145/3377811.3380384