

1 Introduction

Bug studies contribute to improving software quality

Salt is a configuration management system (CMS) that automates process of provisioning servers, configuring and maintaining software systems.

The aim is to find common patterns in the bugs found in the salt configuration management systems.

2 Research questions

1. What are main symptoms of bugs in Salt?
2. What are root causes of bugs in Salt?
3. What are main triggers of the bug-revealing test cases?
4. What is the impact of bugs in Salt?
5. What are the fixes of bugs found in Salt?
6. Are bugs found in salt system-dependent?

3 Methodology

1. Bug collection

- After fetching bugs: 8960 bug reports out of 24509 GitHub issues
- After post-filtering: 5896 bugs with fixes stored in database

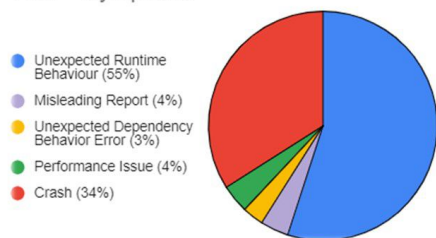
2. Bug Analysis

- Randomly sample 100 bugs to analyze in 5 iterations
- Manually analyze each bug and categorize them based on their characteristics for each research question
- Analysis done in pairs to reduce subjectivity
- Aggregate the categorizations of all bugs and interpret the statistics



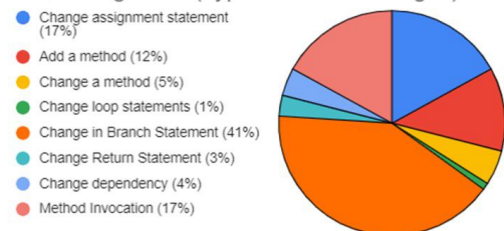
4 Bug Study Findings

RQ1 - Symptoms

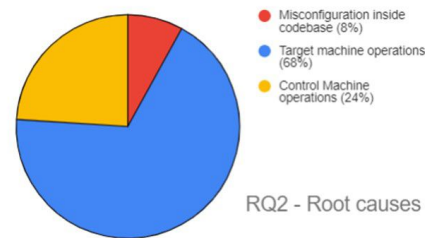


The most common symptom of the bugs is unexpected runtime behavior (55%). Examples of these symptoms are Salt failing to configure or misconfiguring a target machine.

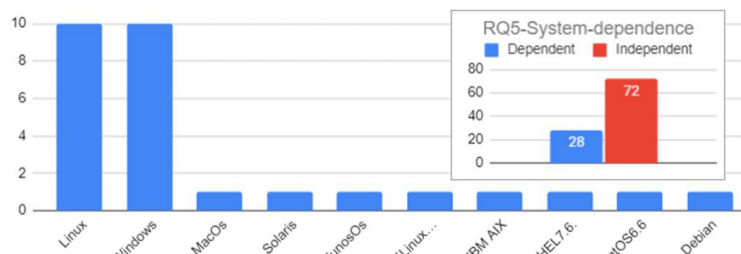
RQ4 - Bug Fixes (Types of Code Changes)



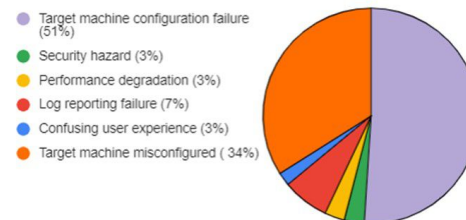
Fixes are mostly small code changes. The majority of the fixes involved changes to branch statements such as if and elif statements



The most common root cause are erroneous execution of arbitrary or predefined commands on target machines (68%). Controller machine operations responsible for sending configurations to target machines and parsing user's configuration files are the second most common root cause.



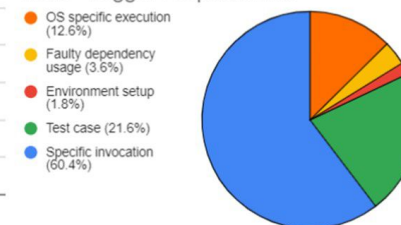
The majority of the bugs manifest regardless of the underlying system (72%). Bugs that were system-dependent, depended mostly on Linux or Windows.



RQ3 - Impact Consequences

The consequence of the bugs are misconfiguration or failure to configure target machines.

RQ6 - Trigger Requirements



The majority of the bugs arise from making use of a specific function in salt's various state and execution modules, caused by parsing errors and combination of optional parameters etc.

5 Conclusion & Future Work

For future work it would be necessary for validation of the categorization of each analyzed bug by another researcher.

The majority of the bugs in salt lie in the state and execution modules and not the modules related to parsing and compiling user specified YAML files or establishing connections between the controller and target machines

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