Intrusion Recovery in Cloud Computing

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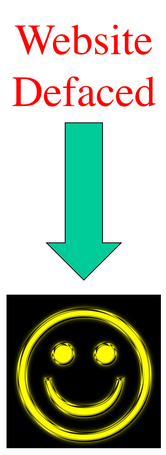
Abstract

- A novel approaches to remove the effects of intrusions in cloud applications
- Does not require modifications to the source code of the application
- Can be deployed in public Cloud offerings
- Use of machine learning algorithms and other techniques to undo the effects of intrusions

Website Defaced



Website Recovered

Backup vs Recovery

Backup

- Undoes everything that happened after the intrusion
- Intrusions detected to late will require older backups
- System is offline during recovery

Recovery

- Only the effects of the intrusion are undone
- No valid data is lost
- Does not require the system to be offline to recover

Step 1 – Finding Intrusion Effects

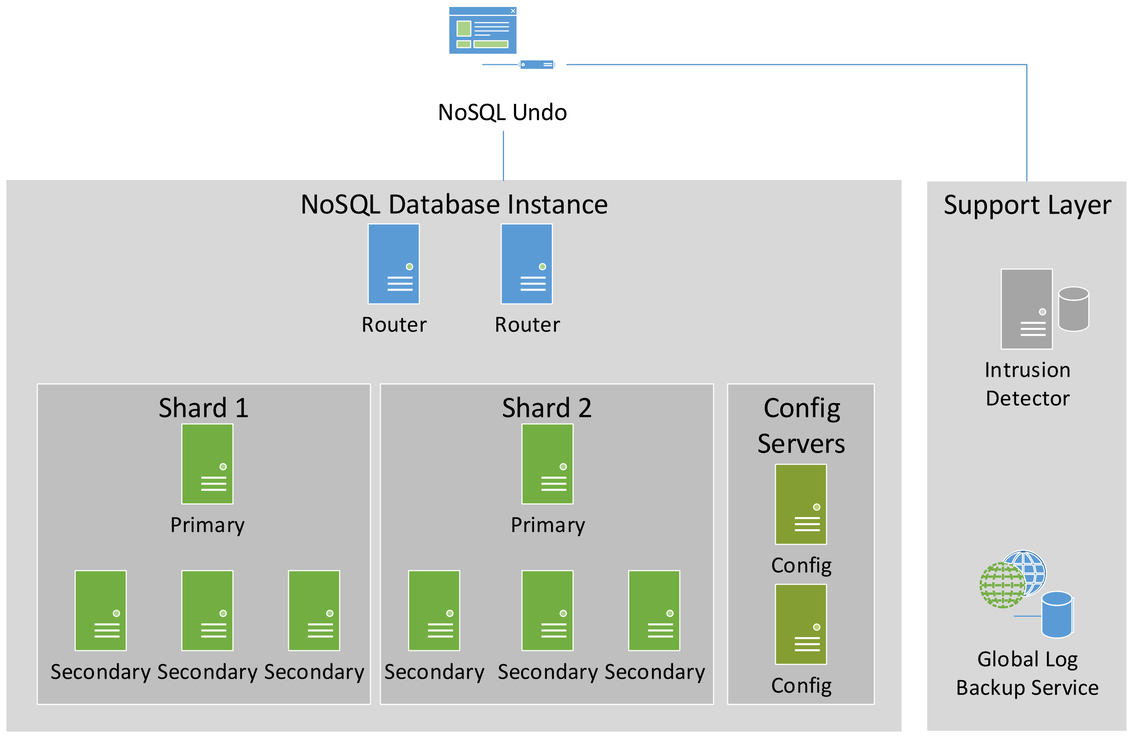
- Each intrusion causes specific effects in the state of the application
- It is possible to identify the one operation that triggered the corruption of the state
- However, calculating the effects of such intrusion is time consuming and delicate.

Step 2 – Reverting Intrusion Effects

- Once every malicious state modification was identified it is necessary to undo them
- It is also necessary to undo malicious operations in such way that the consistency of the application is preserved
- Valid state modification should be kept

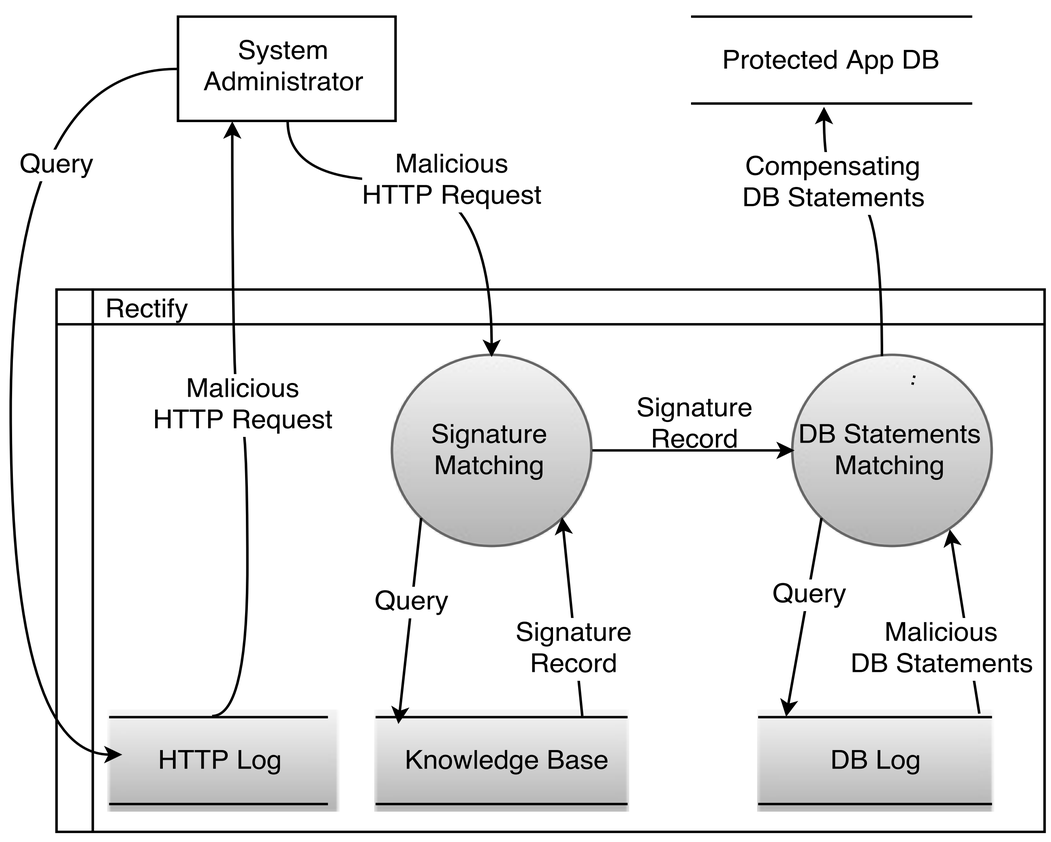
Database recovery: NoSQL Undo

- NoSQL databases are widely used in cloud applications due to their scalability capacity and simplicity
- However, like any other database, it is vulnerable to intrusions
- NoSQL Undo is capable of undoing intrusions from a NoSQL database without requiring it to go offline and preserving every valid operation
- No software modifications are required to the database or application

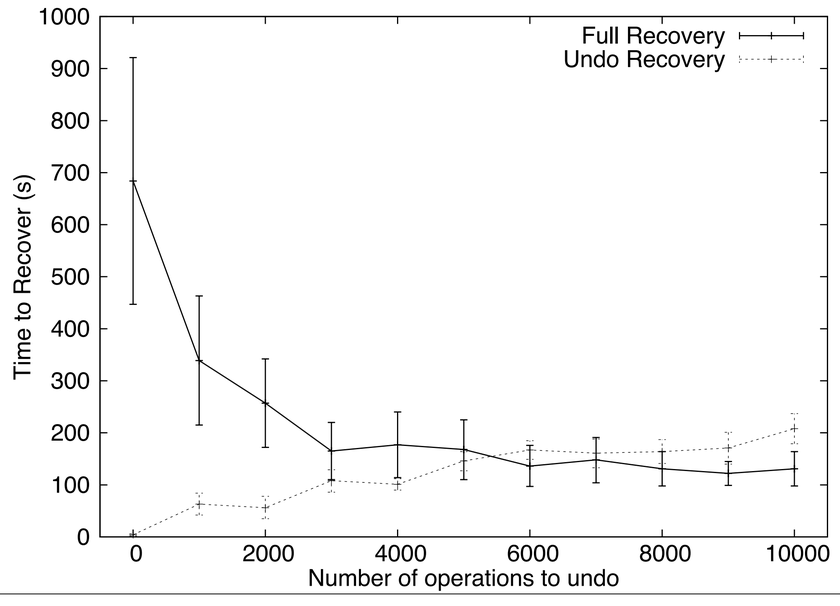


Application recovery: Rectify

- Uses machine learning algorithms to find the effects of intrusions
- Can be deployed alongside web applications in any PaaS
- No software modifications are required



Results – Time to recovery



Results: Overhead