Improving Dynamic Analysis through Partial Replay of Users’ Executions

Alex Orso
Bryan Kennedy
Georgia Institute of Technology
[orso|zendude]@cc.gatech.edu

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GAMMA: Overall Picture

Program P

SE Tasks

Field Data

User

User

User

User

User

User

User

User

[Orso, Liang, Harrold, Lipton, ISSTA’02]
Regression Testing Using Field Data

In-house test suite:
- T1: 1, 2, 4, 6, 7
- T2: 1, 3, 4, 5, 7

Users’ executions:
- U1: 1, 3, 4, 5, 7
- U2: 1, 2, 4, 6, 7
- U3: 1, 3, 4, 6, 7

Impact set = {2, 4, 5, 6, 7}
Critical entities set[3] = {6}

[Orso, Apiwattanapong, Harrold, ESEC/FSE ’03]
Empirical Results

JABA, 14 users, 12 weeks, 20 changes from CVS

Chart showing the number of changes for each critical entity (C01 to C20). The x-axis represents the changes, and the y-axis represents the number of critical entities.
Replaying Executions: Issues

**Practicality**
- High volume of data
- Hard to capture (custom)
- Rich environment

**Privacy**
- Sensitive information

**Safety**
- Side-effects

Partial replay
Replaying subsystems

- Identify subsystem of interest and its boundaries
  - User provided
  - Static analysis
  - Dynamic analysis
- Collect information flowing in and from the subsystem
- Replay the subsystem
Replaying Executions: Scenarios

- Set of subsystem/unit regression tests ("for free" and with oracles!)
- Run your favorite dynamic analysis (No matter how expensive!)

1 ≤ cardinality ≤ #classes in P

Send always VS "anomaly-driven" send

Field VS In-House

Field Data
Technique: Capturing

Program P

Foo
Bar

Configuration

Custom Class Loader

Foo
Bar'

Log

... Bar ...

Alex Orso – Dagstuhl 12/04/03
Technique: Replaying

Program P

Foo
Bar

Replay Driver
Generator

Configuration

Replay Driver

dummyFoo
main
Bar'

Log

JVM
Conclusion

Contribution

- Defined the capture/replay technique
- Developed an initial prototype

Future work

- Add static/dynamic analysis support for selection
- Evaluate the technique for different scenarios
- Extend the technique to handle threads
For more information:

http://gamma.cc.cc.gatech.edu