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Automatic Software Testing Techniques

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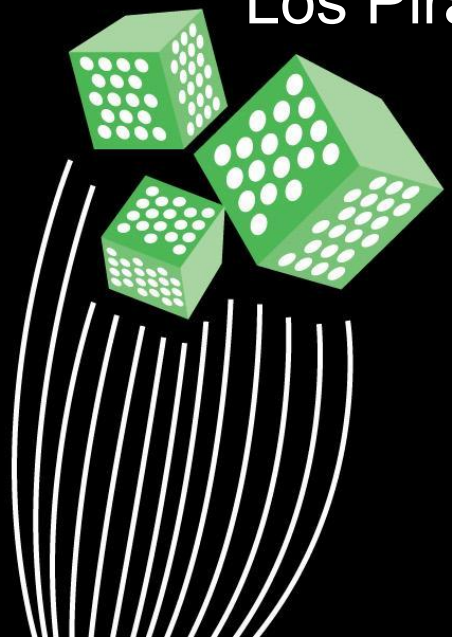
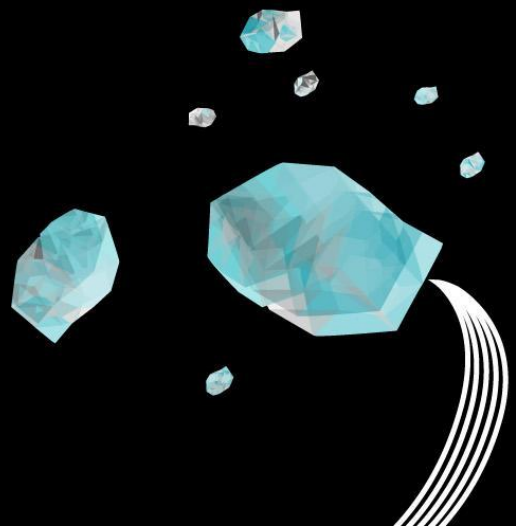
Los Piratas Informaticos





Automatic Software Testing Techniques

- Fuzzing
- Symbolic Execution
- Concolic Execution

Fuzzing

- Black-box
- Provide input
  - Generative
  - Mutative
- Monitor unexpected behaviour
- Discover crashes and memory leaks

Symbolic Execution

- White-box
- Evaluate code symbolically
- Reason about complex program logic
- High code coverage

Challenges

- Constraint Solving
- Memory Modeling
- Concurrency
- Black-box function calls
- Path Explosion

Path Explosion

- Restrict execution depth
- Partial concrete execution
- Pruning
  - RWset

Concolic Execution

- White-box
- Concrete and symbolic
- Reason about complex program logic
- High code coverage
- Alleviate imprecision
- Heavy use of constraint solver

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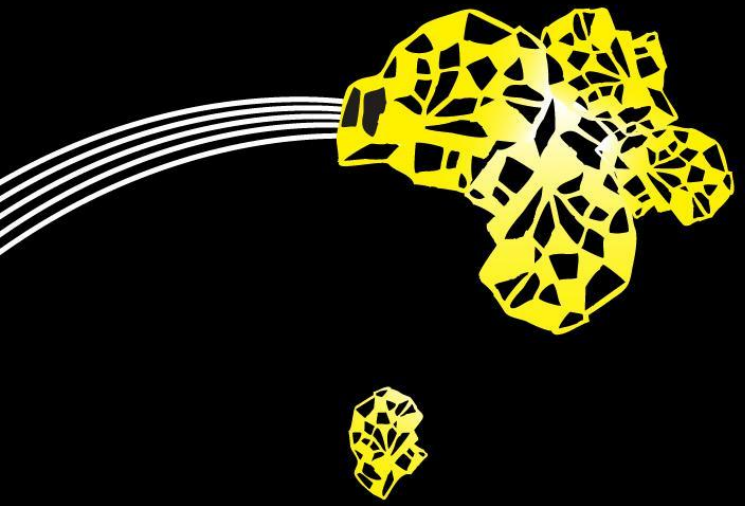
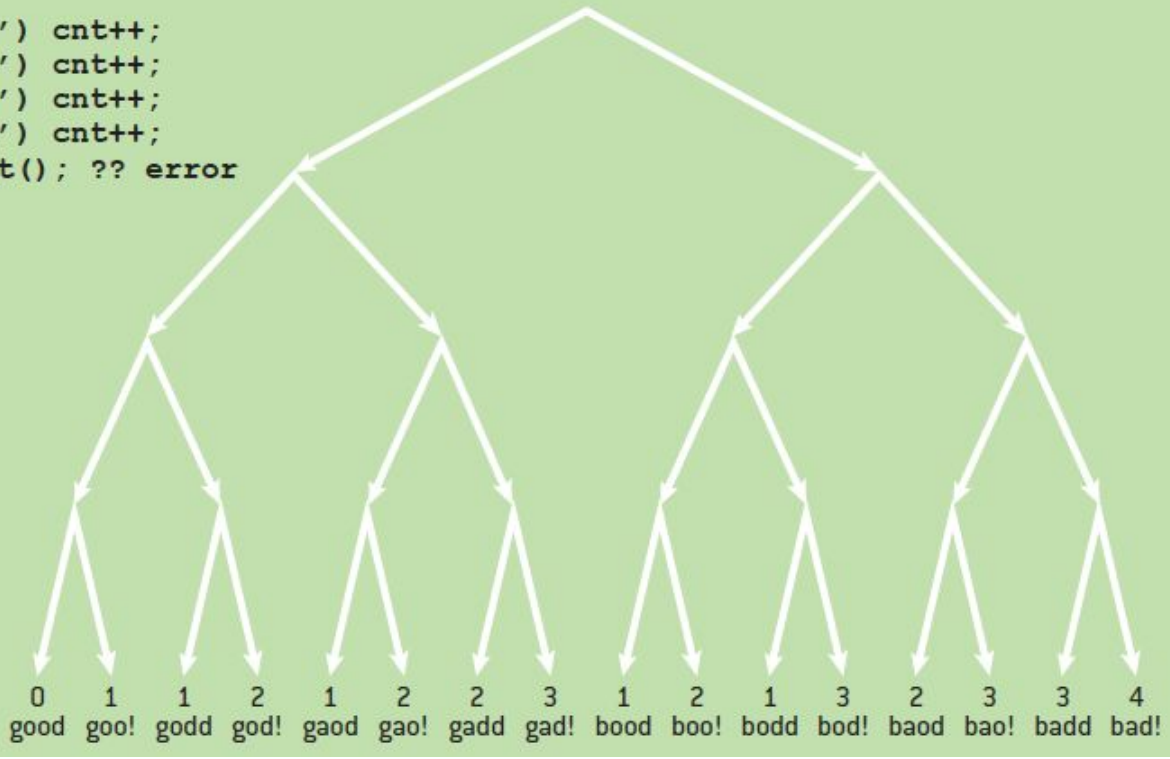


Questions

Execution Tree Example

Example of Program (Left) and Its Search Space (Right) with the Value of cnt at the End of Each Run

```
void top(char input[4] {
  int cnt=0;
  if (input[0] == 'b') cnt++;
  if (input[1] == 'a') cnt++;
  if (input[2] == 'd') cnt++;
  if (input[3] == '!') cnt++;
  if (cnt >= 4) abort(); ?? error
}
```



Godefroid, Patrice, Michael Y. Levin, and David Molnar. "SAGE: whitebox fuzzing for security testing." *Queue* 10.1 (2012): 20.