The Industrial Age of Hacking

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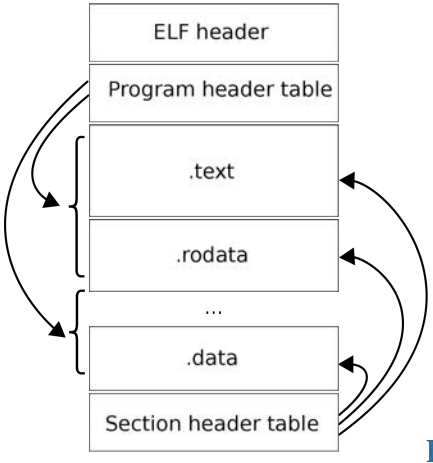
Wouldn't it be great if everyone knew all of this?

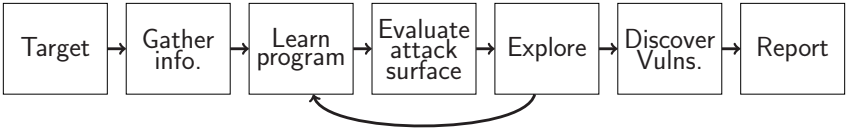


Is it all required?


CGC
CYBER
GRAND_CHALLENGE
CYBER
DARPA
CYBER
DARPA
CYBER


UNITED STATES CYBER COMMAND
24
Mission Support

The hacking process



Hackers vs. Testers: A Comparison of Software Vulnerability Discovery Processes

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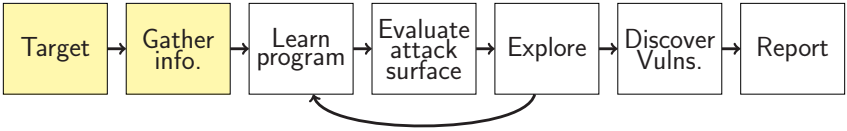
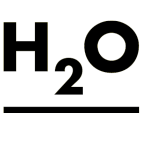
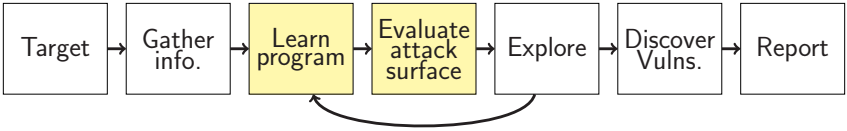
Targeting and information gathering



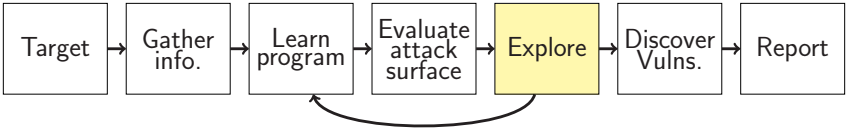


Program understanding and attack surface analysis



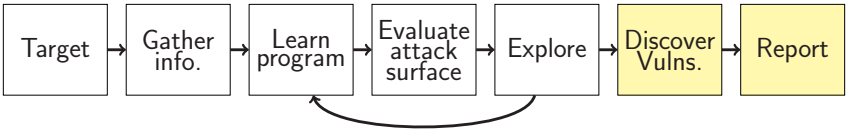
- Identify program's functionality.
- Rehost, emulate, or run.
- Prepare the program for fuzzing.

Exploration




```
/bin/bash
--------------------[  0 days 00 hrs 14 mins 00 secs ]-------/ honggfuzz 1.3 /-
  Iterations : 398,052 [398.05k]
        Mode : Feedback Driven Mode (2/2)
      Target : './httpd/httpd -X -f /home/jagger/fuzz/apache/dist/conf/h ...'
     Threads : 8, CPUs: 8, CPU%: 261% (32%/CPU)
       Speed : 323/sec (avg: 473)
     Crashes : 90 (unique: 1, blacklist: 0, verified: 0)
    Timeouts : [5 sec] 32
 Corpus Size : entries: 1,147, max size: 1,048,792, input dir: 8522 files
  Cov Update : 0 days 00 hrs 00 mins 05 secs ago
    Coverage : edge: 17,019 pc: 410 cmp: 187,266
---------------------------------- [ LOGS ] -----------------------------------
Crash (dup): './SIGABRT.PC.7ffff5ef10bb.STACK.18819c8652.CODE.-6.ADDR.(nil).INST
R.mov____0x108(%rsp),%rcx.fuzz' already exists, skipping
[2018-01-18T22:21:22+0100][W][3343] arch_checkWait():308 Persistent mode: PID 21
623 exited with status: SIGNALED, signal: 6 (Aborted)
Persistent mode: Launched new persistent PID: 24520
Crash (dup): './SIGABRT.PC.7ffff5ef10bb.STACK.18819c8652.CODE.-6.ADDR.(nil).INST
R.mov____0x108(%rsp),%rcx.fuzz' already exists, skipping
[2018-01-18T22:21:23+0100][W][3346] arch_checkWait():308 Persistent mode: PID 18
231 exited with status: SIGNALED, signal: 6 (Aborted)
Persistent mode: Launched new persistent PID: 25094
Size:296441 (i,b,hw,edge,ip,cmp): 0/0/0/0/0/1, Tot:0/0/0/17019/410/187266
```

Vulnerability recognition and reporting



- Explore corpus for bugs: crashes, ASan, valgrind errors.
- Prioritize, filter, and deduplicate.
- Write a report that indicates severity: likelihood of vulnerability, projected investment to convert bug into an exploit.

Combining hackers with machines

Human and machine working together, but how?

The prevailing method: depth-first search

CAUTION: Diamond Mining

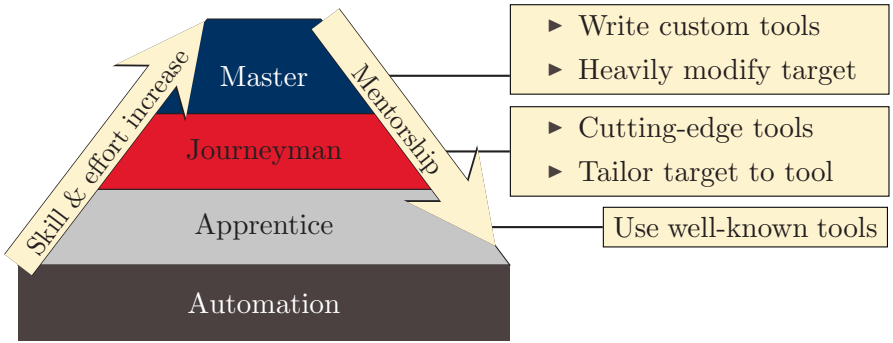
The problem

$$R = \frac{\mathbf{T} \times \mathbf{S}}{\mathbf{L} \times \mathbf{V}}$$

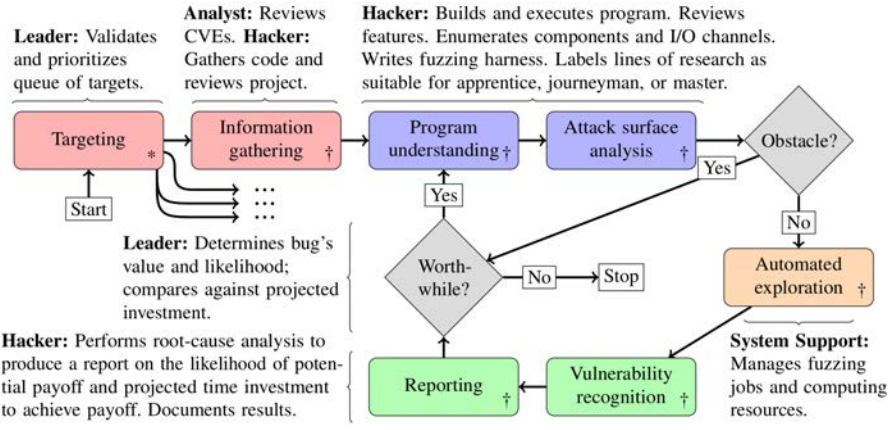
Increases **R**isk:	Decreases **R**isk:
Projected **T**ime investment	**L**iklihood of success
Required **S**kill level	**V**alue of success

A deliberate risk formula

Our method: breadth-first search

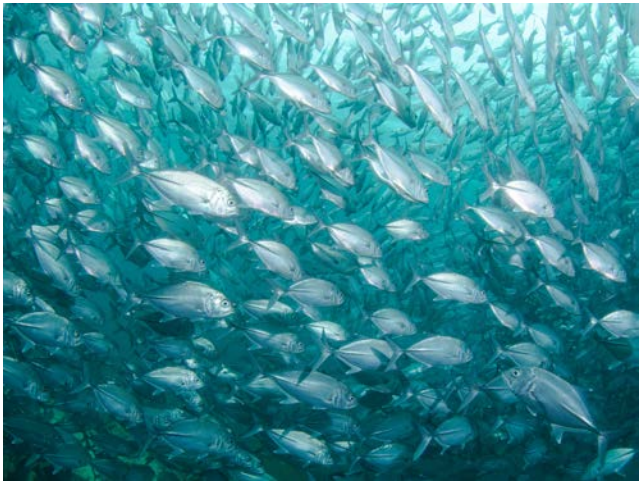


Our method: breadth-first search



Our vulnerability-discovery process adds targeting (*) to the steps of Votipka, et al. (†)

Metaphor: fishing For bugs



There are fish out there. How do we best catch them?

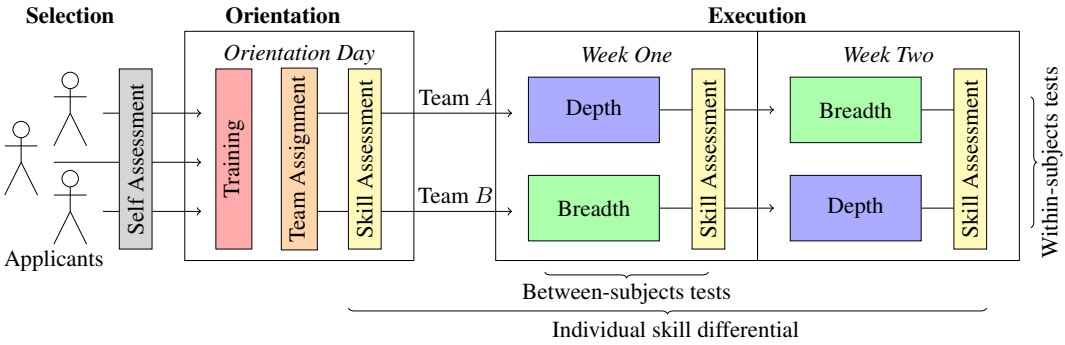
Metaphor: fishing For bugs

Larger holes in net $\implies$ less friction.

Metaphor: fishing For bugs

Some fish might escape, but we cover more area.

Experimental design



Target selection

Google

?

Target selection

Something else entirely

Strict schedules

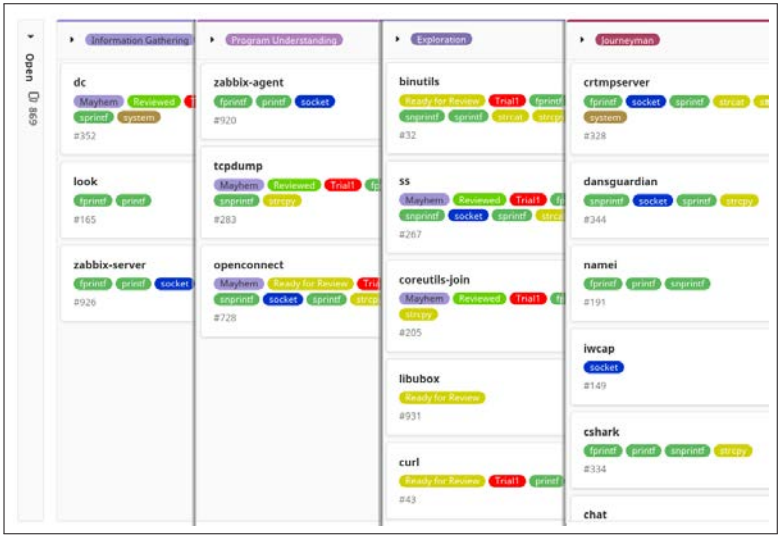
Workflow

Target Information gathering

Program understanding Attack surface

Automated exploration

Promote to journeyman



Results: surveys

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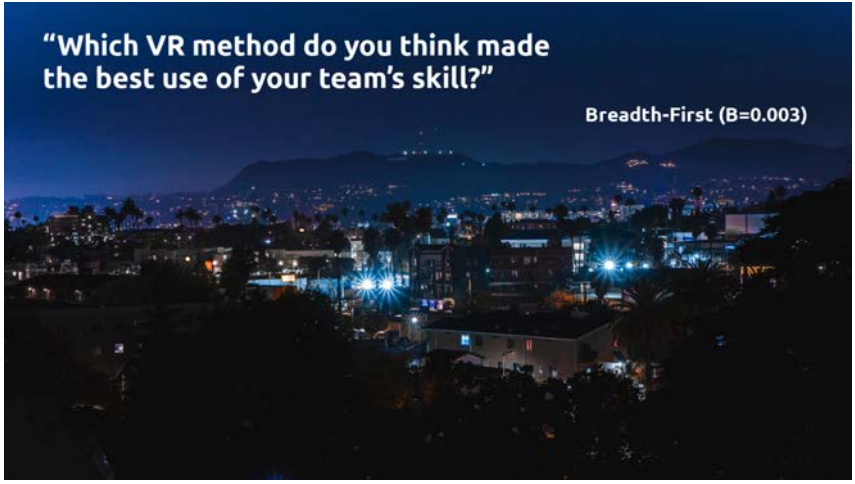

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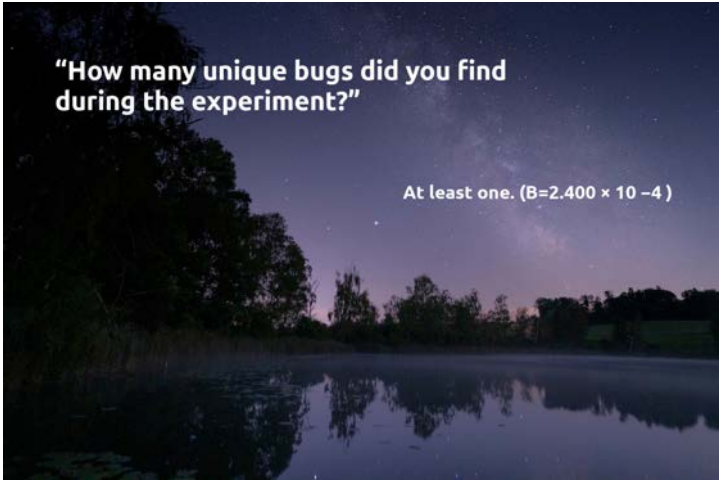
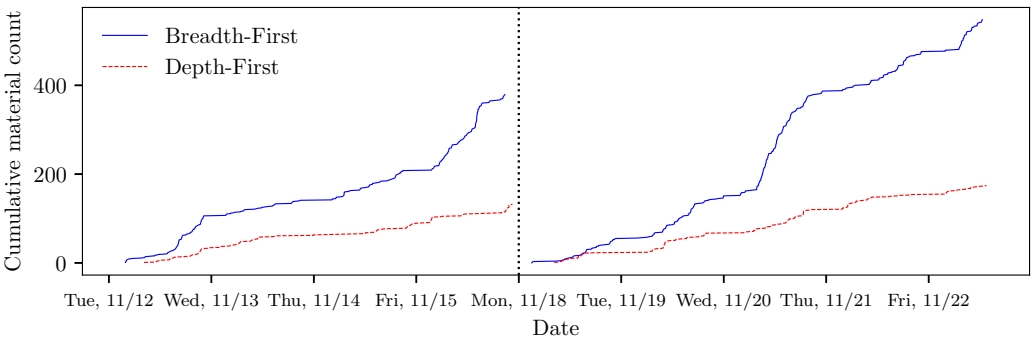


Results: bugs found

Team	Method	Harnesses	T_0	T_1	T_2
A	S_D	8	3	2	3
A	S_B	42	31	23	40
B	S_B	61	42	49	40
B	S_D	12	4	4	4

Results: documentation produced



Conclusion

We described a repeatable experiment for measuring a novel workflow that:

- efficiently uses human resources, both novice and expert,
- **finds more bugs**,
- produces more documentation and learning resources,
- better applies automated bug-finding tools, and
- clearly defines work roles.

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