Detecting Bugs at Scale with Semgrep

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Image credit: *Lost in Random*, Zoink/Electronic Arts

TL;DW

Too Long;
Didn't Watch!

Image credit: Myself - The Semgrep Logo belongs to r2c

Yours Truly

2013-2019: Cigital/Synopsys - consulting

Web -> Mobile -> Thickclients/Blockchain (lol)

DEF CON 26

Tineola Taking a Bite Out of Enterprise Blockchain

2019 - 2022: Electronic Arts - security “engineer”

Videogames -> Dynamic testing ->

Source code review -> Semgrep

DEF CON 28 Appsec Village

localghost: Escaping the Browser Sandbox without 0-Days

2022: Unemployed and a burden on society

Episode 1: Static Analysis

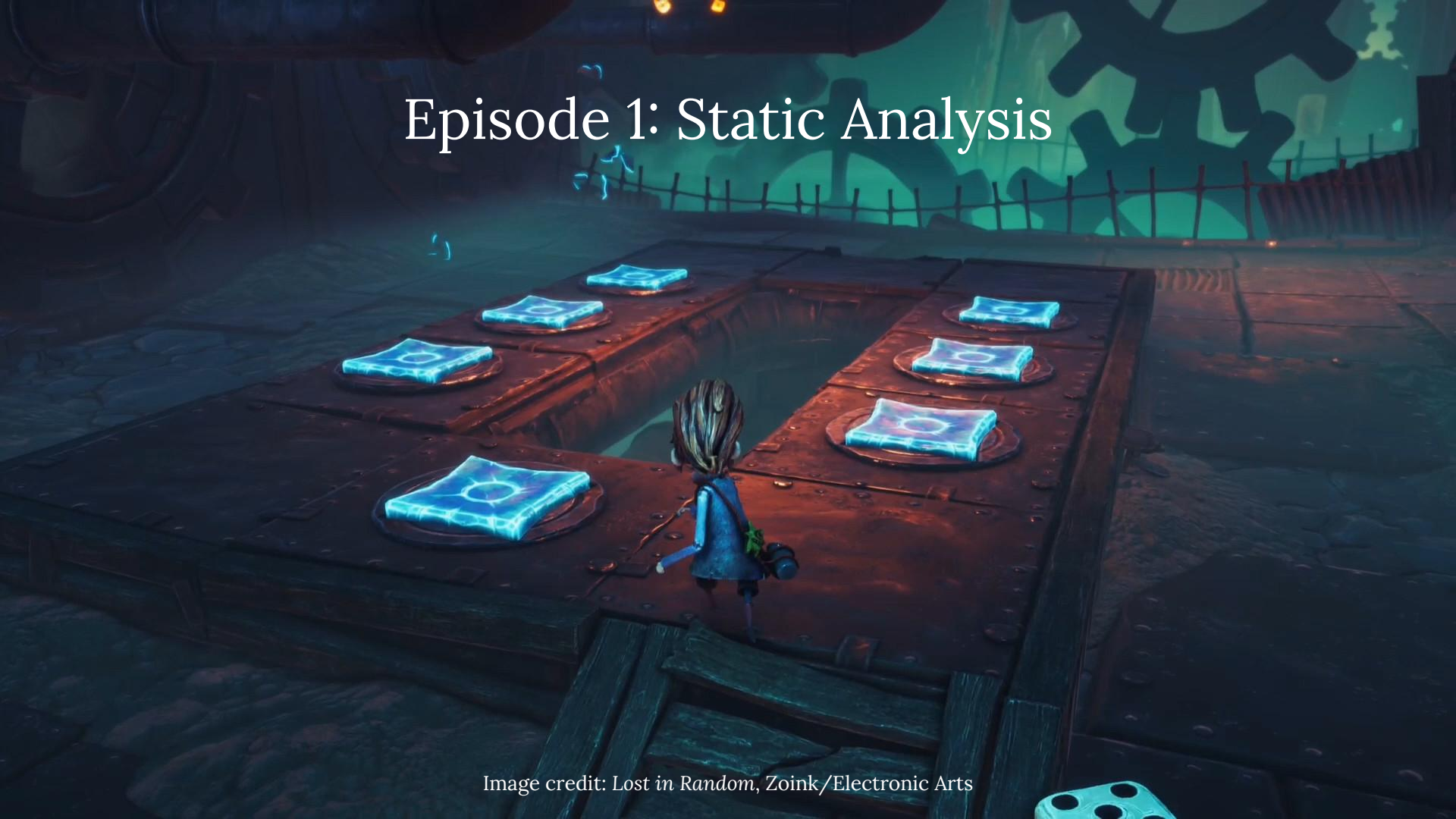


Image credit: *Lost in Random*, Zoink/Electronic Arts

Inside You There are Two Wolves

Security Engineer

Developer

Image credit: Victor Becker
Lost in Random, Zoink/Electronic Arts

Inside Your SAST There are Two Wolves

For Security Engineers	**For Developers**
Some noise is OK.	Any noise is bad!
Can be slow.	Must be quick*.
Manual usage is tolerated.	Should be part of CI/CD.
Alert on everything.	Never break the build.
Configuration/tuning is expected.	The tool should work out of the box.

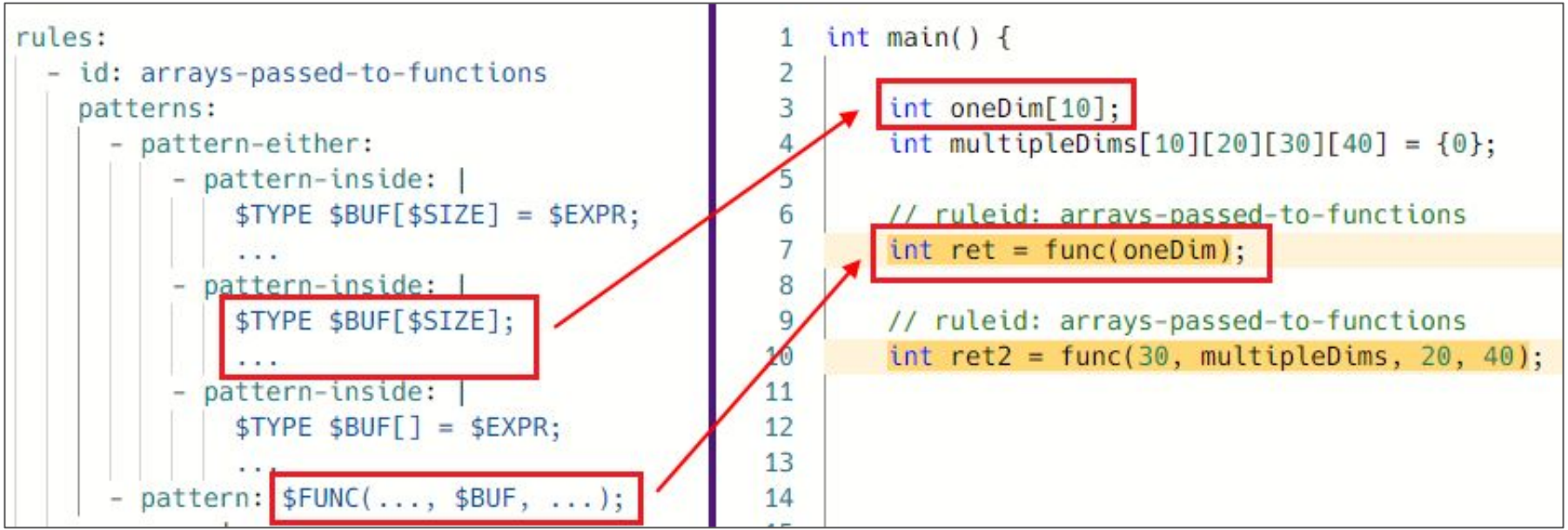
Episode 2: Semgrep

Image credit: *Lost in Random*, Zoink/Electronic Arts
The Semgrep logo belongs to r2c

Semgrep vs. CodeQL vs. Coverity vs. … !

Image credit: *Lost in Random*, Zoink/Electronic Arts

Rules are Easy!



Semgrep Limitations

Weak multi-file analysis - Limited taint tracking
Join Mode, DeepSemgrep (paid)

Limited set of available rules
We must create custom rules

Image credit: *Lost in Random*, Zoink/Electronic Arts

Episode 3: The Lay of the Land

Image credit: Leo Brynielsson
Lost in Random, Zoink/Electronic Arts

Code, Configs and more Code!

Image credit: *Lost in Random*, Zoink/Electronic Arts

Dependency Hell

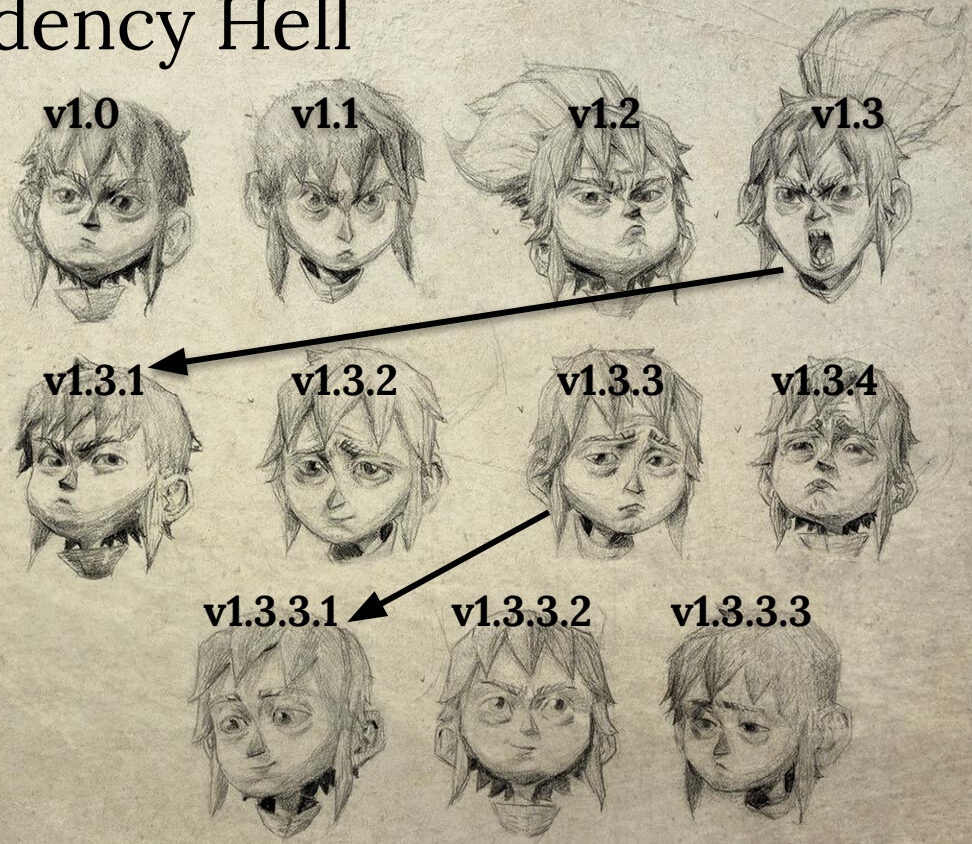


Image credit: Victor Becker
Lost in Random, Zoink/Electronic Arts

Source Code Management

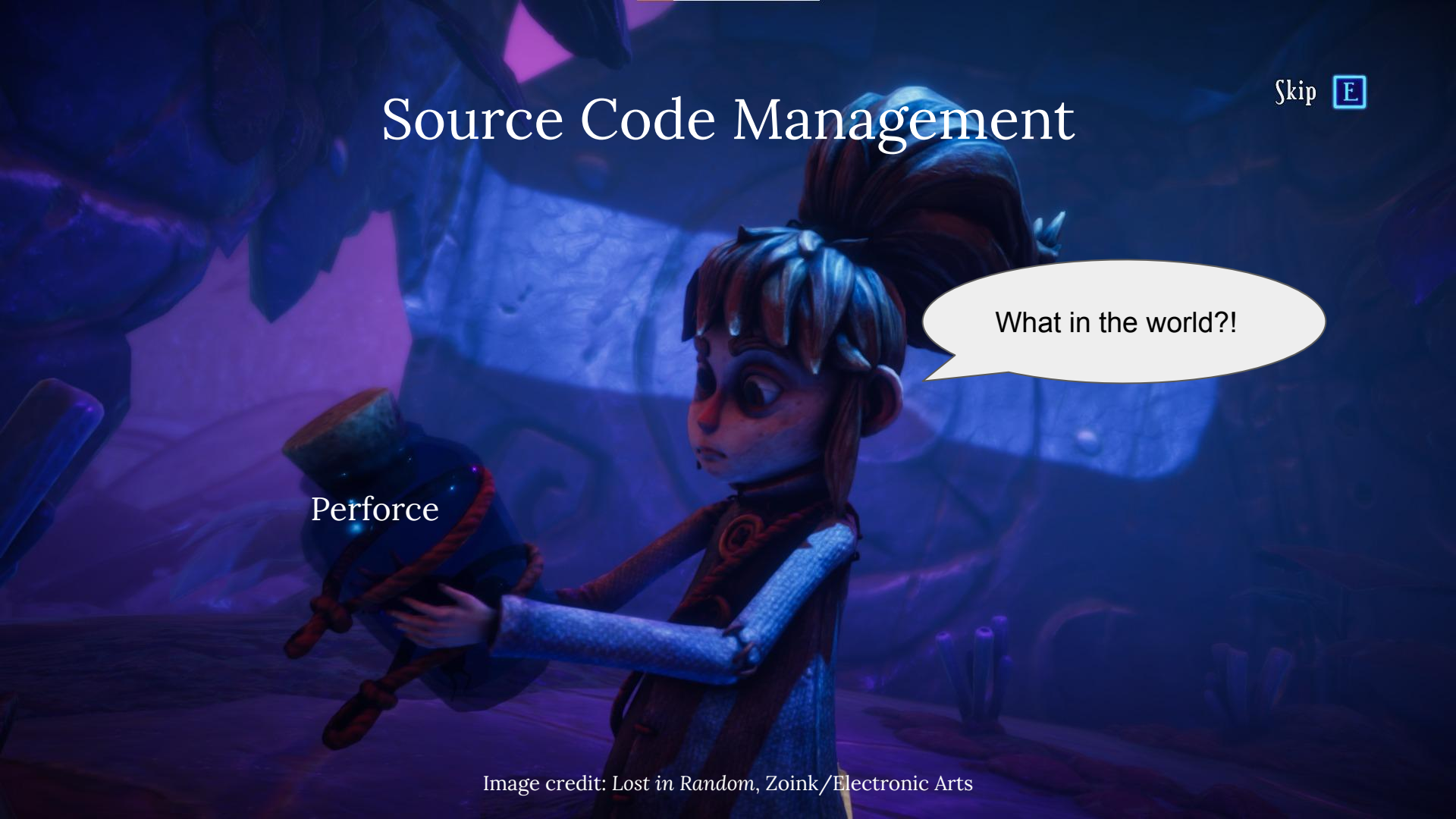


Image credit: *Lost in Random*, Zoink/Electronic Arts

~~Webview~~ Chromium Desktop Apps

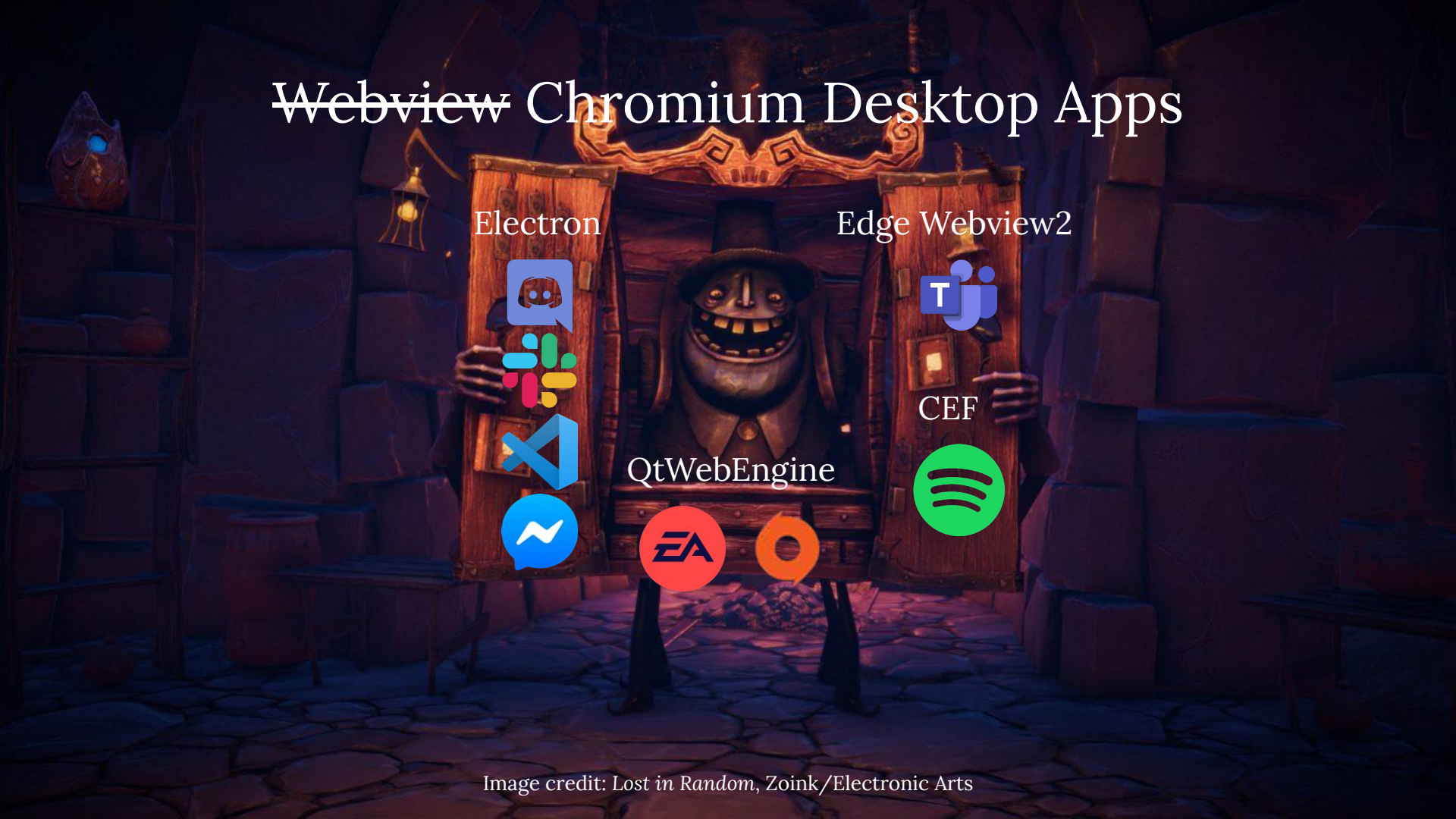
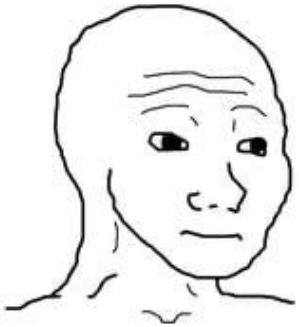
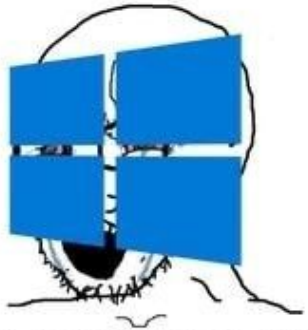


Image credit: *Lost in Random*, Zoink/Electronic Arts

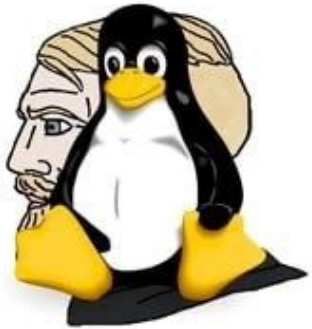


hey can i uninstall edge



NOOO!!! YOUR SYSTEM WILL BREAK

im going to uninstall the bootloader



go ahead lol

What to Look For?

Normal webapp client-side and server-side tests.

XSS -> RCE is a meme but mostly true.

As easy as

<img src=x onerror=document.location="file:///C:/windows/system32/calc.exe">

Special Webview App Things:

Protocol Handlers. E.g., slack://blah.

Local servers. E.g., RCE in PlayStation Now and RCE in VS Code WSL Extension.

The JavaScript Bridge or what can you call after an XSS?

Client-side Storage

Episode 4: Automation

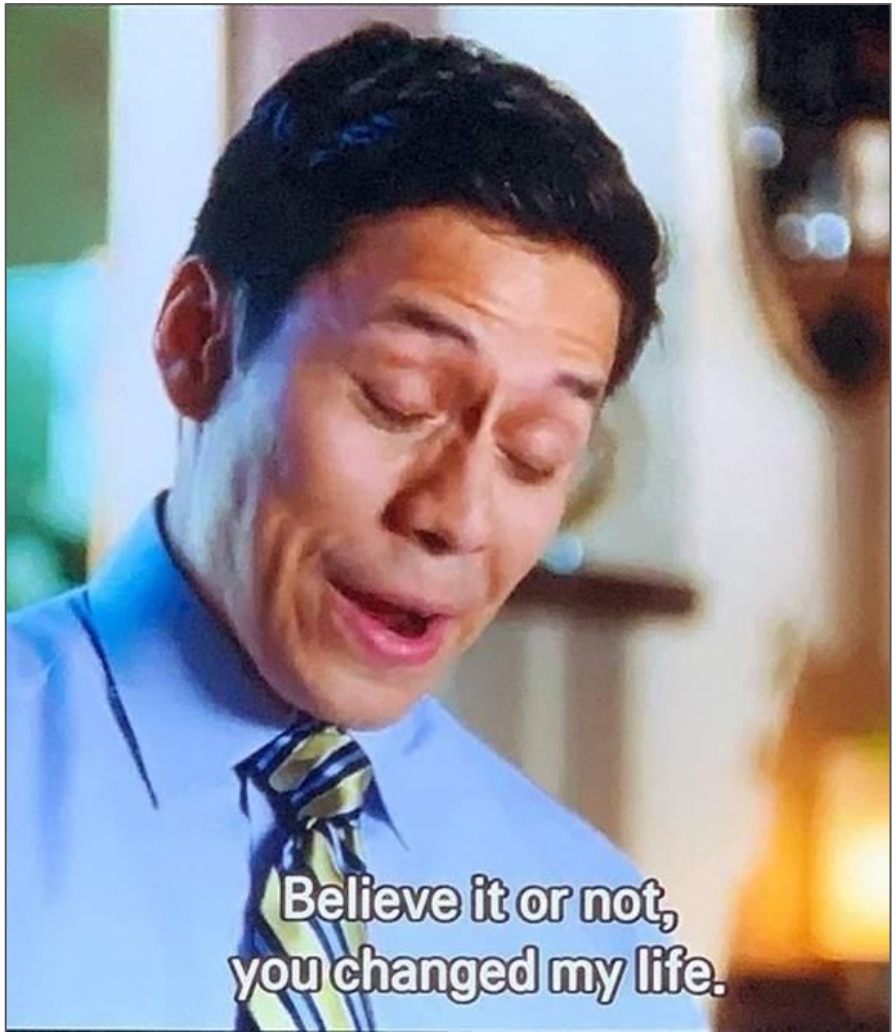
Image credit: *Lost in Random*, Zoink/Electronic Arts

Manual Work is a Bug

A.B.A: always be automating

1. Documenting the steps.
2. Create automation equivalents.
3. Create automation.
4. Self-service and autonomous systems.

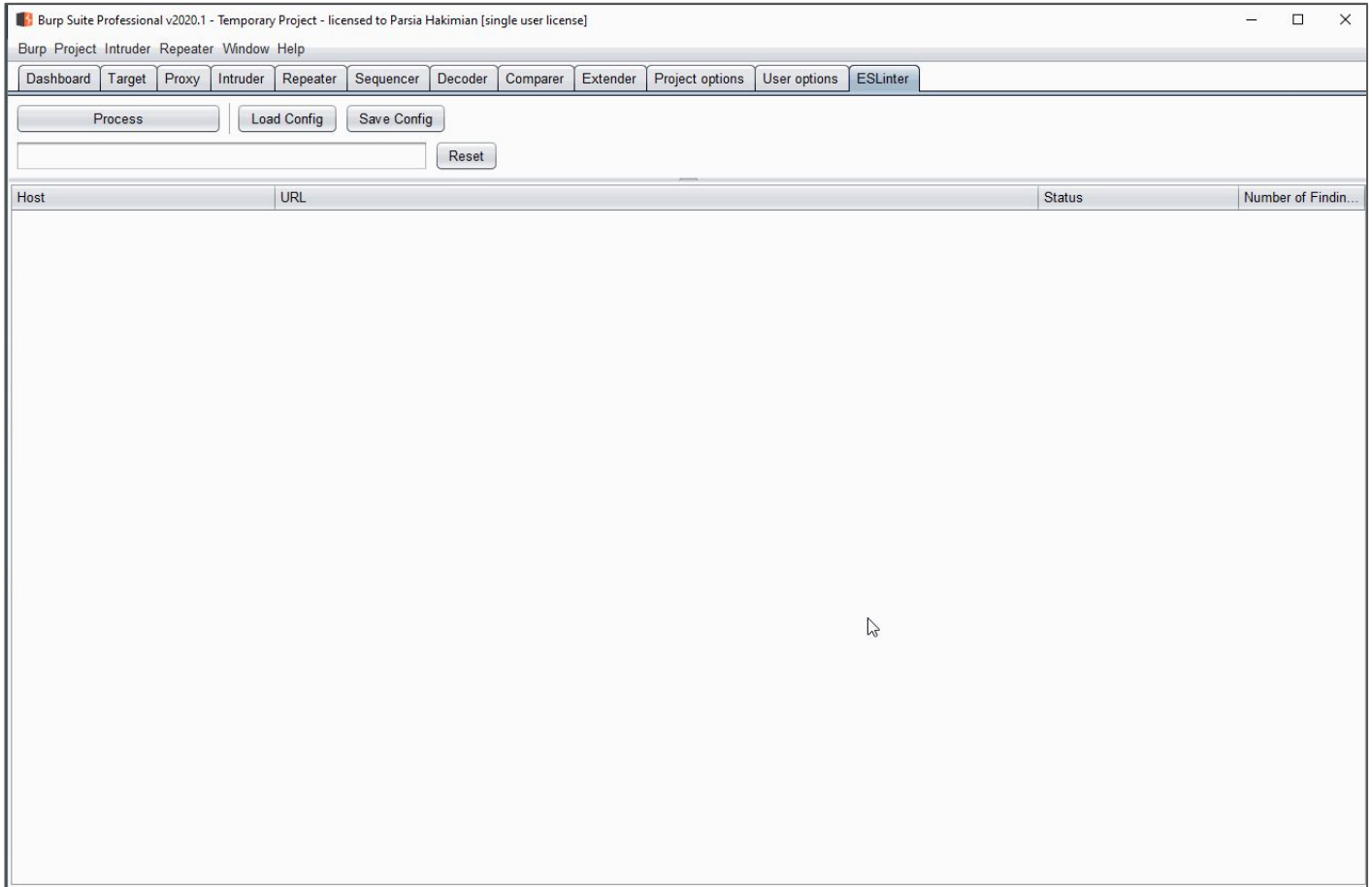
https://queue.acm.org/detail.cfm?id=3197520



Literature Review

Academic Papers Industry Netflix (lol)

Some Early Automation: ESLinter



Semgrep Usage

What rules are used?

Where does the output appear?

How is Semgrep executed?

Image credit: *Lost in Random*, Zoink/Electronic Arts

For Security Engineers - How?

How do you run it?

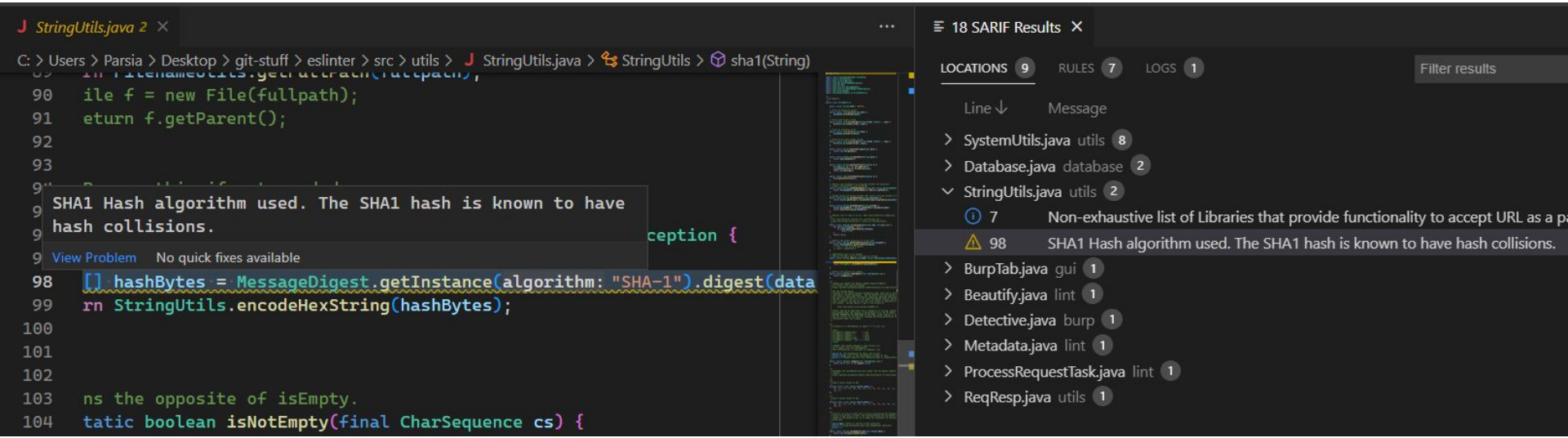
It can be manual.

$ semgrep --config /myrules/ --sarif --output myresults.sarif /path/to/code

For Security Engineers - Output

Where is the output stored?

Use a SARIF viewer.



For Security Engineers - Rules

Image credit: *Lost in Random*, Zoink/Electronic Arts

Detecting XXE in Java

Let's find every Java XML parser!

parsiya: blog-2022-03-java-xxe

SEMGREP RULE

Simple Advanced

```yaml
rules:
- id: blog-2022-03-java-xxe
  patterns:
    - pattern-either:
      - pattern: import DocumentBuilderFactory;
      - pattern: import XMLInputFactory;
      - pattern: import DOMParser;
      - pattern: import TransformerFactory;
      - pattern: import Validator;
      - pattern: import SchemaFactory;
```

TEST CODE

```
1  import javax.xml.parsers.DocumentBuilderFactory;
2  import javax.xml.stream.XMLInputFactory;
3  import oracle.xml.parser.v2.DOMParser;
4  import javax.xml.transform.TransformerFactory;
5  import javax.xml.validation.Validator;
6  import javax.xml.validation.SchemaFactory;
7  import javax.xml.transform.sax.SAXTransformerFactory;
8  import org.xml.sax.XMLReader;
9  import org.dom4j.io.SAXReader;
10 import org.jdom2.input.SAXBuilder;
11 import javax.xml.bind.Unmarshaller;
12 import javax.xml.xpath.XPathExpression;
13 import java.beans.XMLDecoder;
14
15 import javax.whatever.Whatever;
```

Keywords in Function Names - Encode/Decode

encode-decode-in-function-name

simple mode | advanced mode

```yaml
rules:
  - id: encode-decode-in-function-name
    patterns:
      - pattern: |
          $FUNC(...);
      - metavariable-regex:
          metavariable: $FUNC
          regex: .*(encode|decode).*
    message: Encoding/decoding function, worth a review.
    languages:
      - cpp
    severity: WARNING

```

test code | metadata | docs

```cpp
int main() {

    // ok:encode-decode-in-function-name
    randomfunc();

    // ruleid:encode-decode-in-function-name
    encodeme();

    int param = 1;
    // ruleid:encode-decode-in-function-name
    int res = decodeme(param);

    // ruleid:encode-decode-in-function-name
    thisencodefunctionisbad();

    // ok:encode-decode-in-function-name
    int res2 = safefunction();

    return 0;
}
```

And there's more!

Other tickets - incoming vulnerability reports

Find the root cause in source code and write rules.

Crypto(graphic) primitives - MD5

MD5

Memory-safe language - Unsafe

Hardcoded secrets

C++ - https://github.com/parsiya/semgrep-hotspots

sizeof(pointer*)

Snprintf

For Developers

Image credit: *Lost in Random*, Zoink/Electronic Arts

For Developers - Output

Parse the SARIF results and do whatever.

- https://github.com/microsoft/sarif-tools
- https://github.com/parsiya/sarif-info

We explored some options like

- Automatic tickets in Jira or … .
- Slack notifications.
- Pull/Merge request comments.

For Developers - Rules

Ask them!

- What keep you up at night?
- Which section of the codebase is vulnerable?
- What kind of security issues are important to you?

Show them!

- How rules are written.
- How Semgrep works.

They will start writing their own rules.

For Developers - Rules

Don’t have noise! You will lose their trust!

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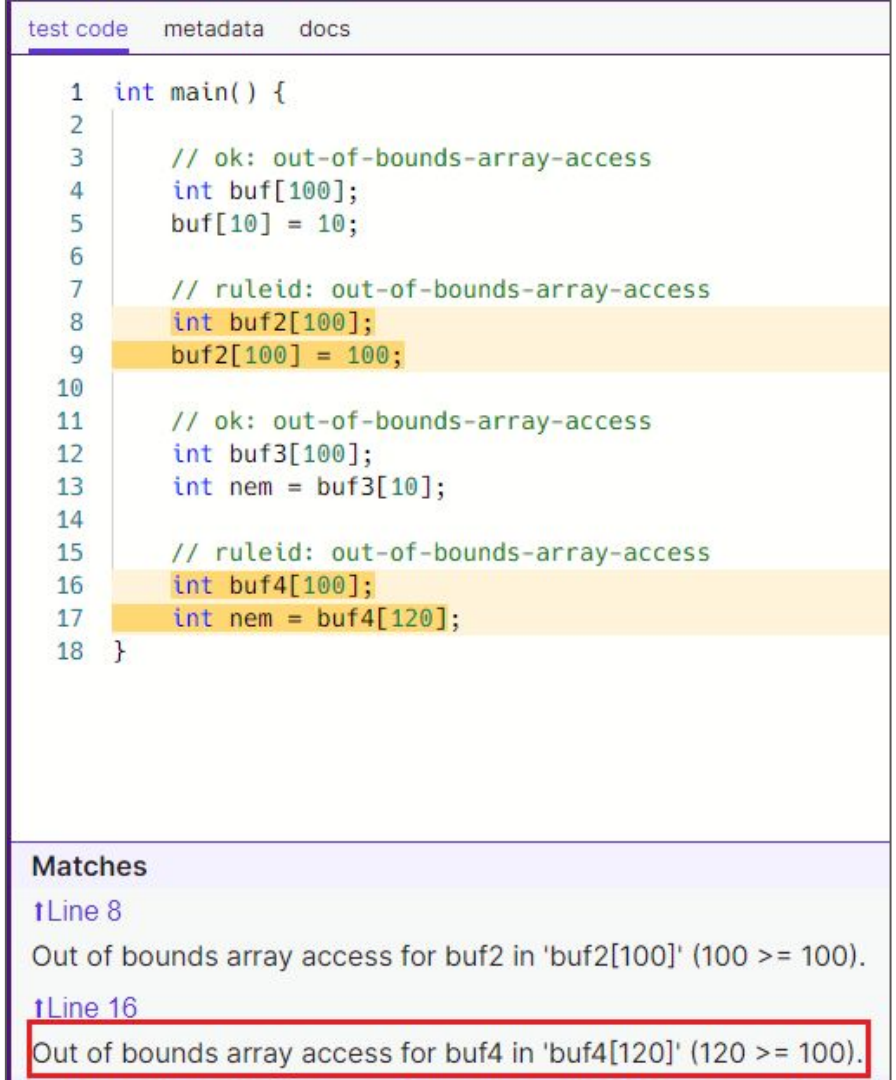

Don’t Break the Build!

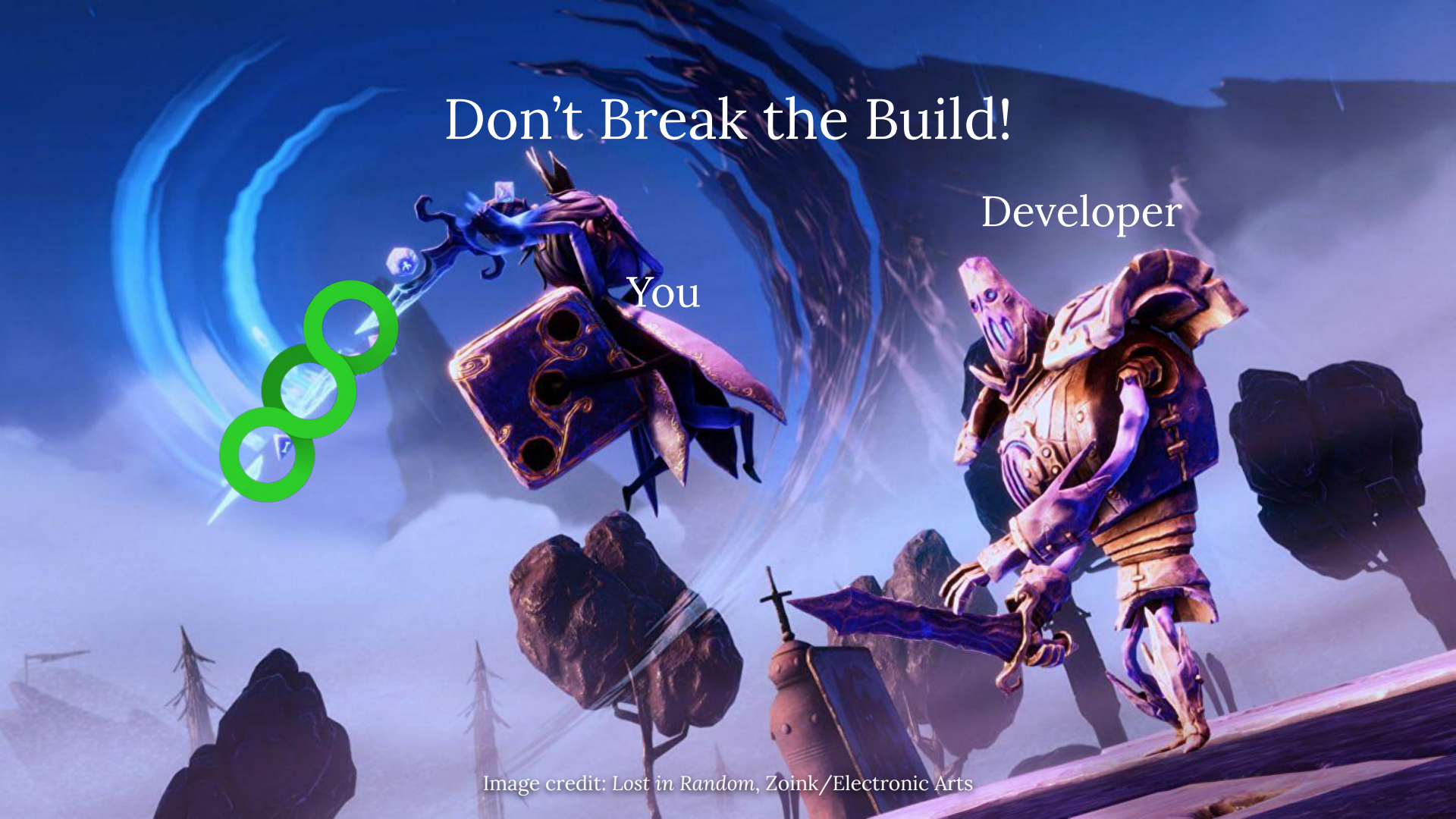

Image credit: *Lost in Random*, Zoink/Electronic Arts

Moral of the Story

Image credit: *Lost in Random*, Zoink/Electronic Arts

What Did We Learn Here Today?

Semgrep is free and fun. Please use it!

Write your own rules.

- Keep the noisy rules for yourself.
- Send accurate rules to the developers.

Try to make the process as seamless as possible for them.

Encourage the developers to experiment with Semgrep and write rules.

Bonus: Where Do I start?

Static Program Analysis: https://cs.au.dk/~amoeller/spa/

Learn Semgrep: https://semgrep.dev/learn

Protocol Handlers:

- https://parsiya.net/blog/2021-03-17-attack-surface-analysis-part-2-custom-protocol-handlers/

Local Servers:

- localghost: Escaping the Browser Sandbox without 0-Days
- RCE in PlayStation Now
- RCE in VS Code WSL Extension

The JavaScript Bridge in Modern Desktop Applications

Bonus: Where Do I start? Continued

Manual Work is a Bug

https://queue.acm.org/detail.cfm?id=3197520

ESLinter: Manual JavaScript Linting is a Bug

https://github.com/parsiya/eslinter

Semgrep in the CI/CD Pipeline

GitHub Action
GitLab SAST
OWASP secureCodeBox

Semgrep Hot Spots

https://parsiya.net/blog/semgrep-hotspot/
https://github.com/parsiya/semgrep-hotspots

Bonus: Where Do I start? Continued

Semgrep Deployment

- Building a SAST program at Razorpay's scale
- A Guide On Implementing An Effective SAST Workflow

Questions

twitter.com/CryptoGangsta

parsiya.net

github.com/parsiya

Image credit: *Lost in Random*, Zoink/Electronic Arts