Leveraging Flawed PHP Tutorials for Seeding Large-Scale Web Vulnerability Discovery

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Origins

Oakland'14: Modeling and Discovering Vulnerabilities with Code Property Graphs

Joern

Euro S&P'17: Efficient and Flexible Discovery of PHP Application Vulnerabilities

Joern for PHP

Pitch

Hypothesis: Vulnerabilities in popular tutorials **propagate** to production code

Our proposal

Use **pattern mining** to:

- Examine hypothesis
- **Scale up** vulnerability search

Key Results

- **64,415** repos scanned, **117** vulnerabilities

Hypothesis validated!

- **8 SQLi** vulnerabilities traced to a **single** tutorial!
- Used a standard **PC** and broadband **DSL**

Low barrier to entry!

Motivation

Manual audit of popular PHP tutorials betrayed lack of security understanding

If developers **borrow** code, they borrow **vulns**

Design

Vulnerable Tutorial

Template

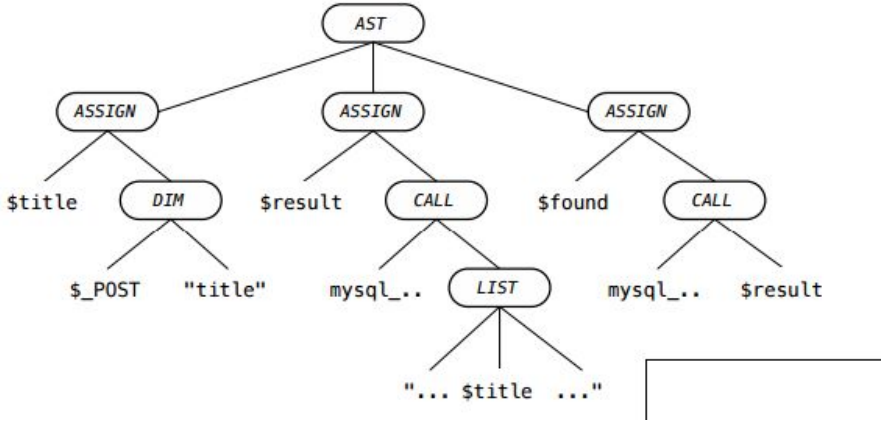
Graph Traversal

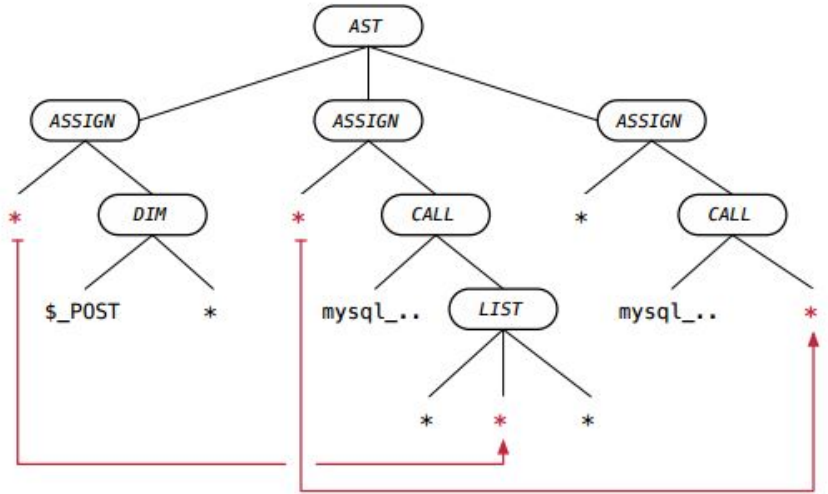
GitHub

Analogue

Example

```
$title=$_POST["title"];
$result=mysql_query("SELECT * FROM wp_posts where;
   post_title like '%$title%' and post_status='publish'");
$found=mysql_num_rows($result);
```





Implementation

- Template generation ⇒ **Lightweight PHP parser**
- Traversals ⇒ **Gremlin**
- Python GitHub Crawler
- Code serialization ⇒ **Joern for PHP**

https://github.com/tommiu/ccdetection

Results

Data set	Size	Num. Analogues	Num. Vulnerabilities
Not popular	42,064	269	80 (29.74%)
Popular	16,037	528	35 (6.63%)
Very popular	6,314	23	2 (8.7%)
Total	**64,415**	**820**	**117 (14.27%)**

Insights

- Traversals efficient for scaling up analysis
- Structural analysis (AST) robust
- Run time for top 10 PHP projects low
- Standard desktop PC ⇒ **19s < t < 53 m**

Summary

- Developers consult **informal** documentation
- Poorly written tutorials may put software at risk
- Finding vulnerabilities from tutorials is **possible**

Future Work

- Language agnostic analogue detection
- Plug-in for IDEs such as Eclipse

Code

Joern

https://github.com/octopus-platform/joern

PHP Joern

https://github.com/malteskoruppa/phpjoern

GitHub Spider

https://github.com/tommiu/GithubSpider

Questions?

Related Work

- **Code clone finders**
  - Code borrowed from tutorials likely lexically different
  - Lexical matching ⇒ **False negatives**
- **Vulnerability scanners**
  - **Not** yet another PHP vuln scanner
  - Intended to shed light on unsafe coding practices