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Presentation

JAW: Studying Client-side Cross-Site Request Forgery with Hybrid Property Graphs and Declarative Traversals

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OVERVIEW

- Introduction
- JAW
- Architecture and Design Of JAW
- Evaluation and Analysis of Collected Data
- Limitations and Future Work
- Conclusion and Observation

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INTRODUCTION

Cross-Site Request Forgery

- Definition

"Cross-Site Request Forgery (CSRF) is an attack that forces an end user to execute unwanted actions on a web application in which they're currently authenticated. With a little help of social engineering (such as sending a link via email or chat), an attacker may trick the users of a web application into executing actions of the attacker's choosing".

-OWASP

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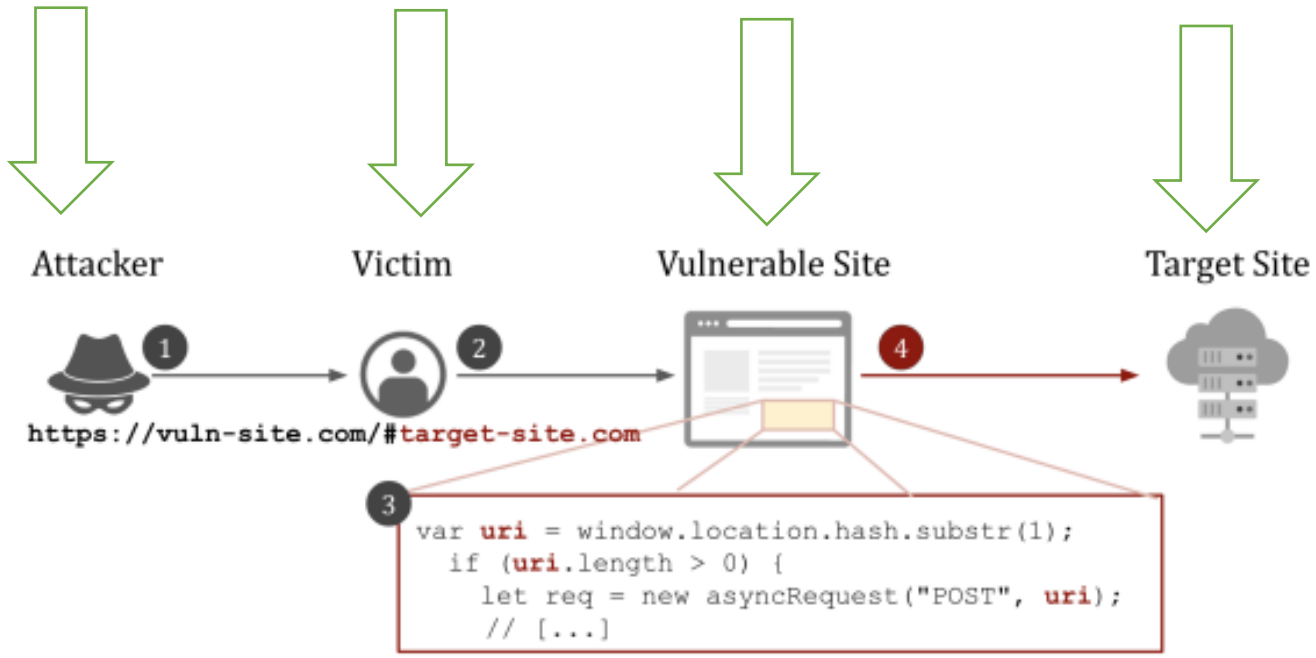
INTRODUCTION- CONT.

Cross-Site Request Forgery- Attack



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INTRODUCTION

Cross-Site Request Forgery

- GET scenario

```
http://bank.com/transfer.do?acct=BOB&amount=100 HTTP/1.1

http://bank.com/transfer.do?acct=MARIA&amount=100000

<a href="http://bank.com/transfer.do?acct=MARIA&amount=100000">View my Pictures!</a>
Or as a 0x0 fake image:
<img src="http://bank.com/transfer.do?acct=MARIA&amount=100000" width="0" height="0" border="0">
```

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INTRODUCTION

Challenges

- Vulnerability-specific Analysis Tools
- Event-based Transfer of Control
- Dynamic Web Execution Environment
- Shared Third-party Code

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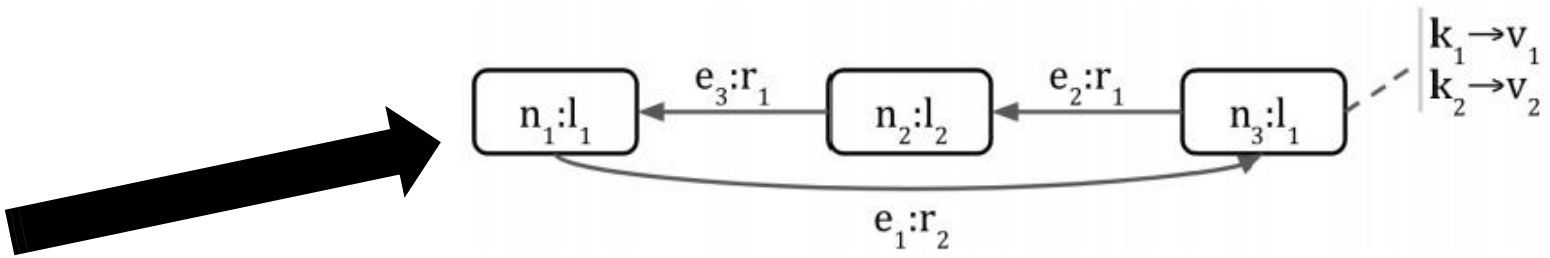
JAW

Why JWA ?

- ➢ Hybrid Property Graphs



- ✓ HPGs provide a uniform canonical representation for JavaScript source code.
- ✓ Perform a variety of security tasks.
- ✓ Understand event-based transfer of control by proposing the Event Registration
- ✓ Captures the dynamics of the web execution environment of client-side JavaScript

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ARCHITECTURE AND DESIGN OF JAW

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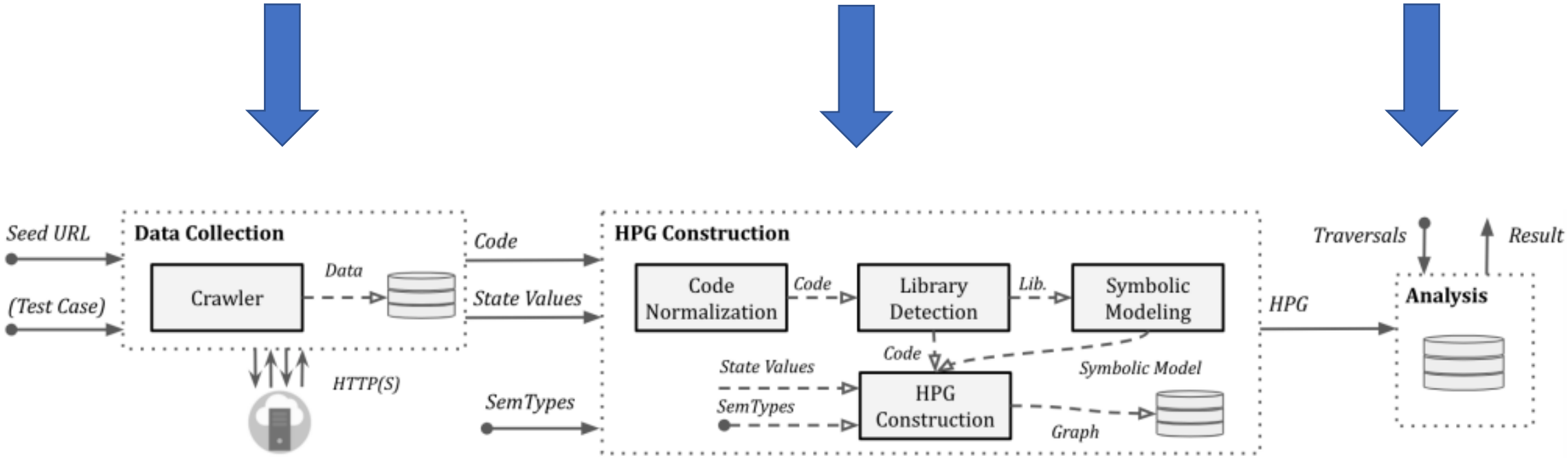
ARCHITECTURE OF JAW



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Evaluation and analysis

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EVALUATION

Run JAW on 4,836 web pages.

- Evaluation of JAW uncovered 12,701 forgeable client-side requests affecting 87 web applications.
- For 203 of them, created a working exploit against seven applications that can be used to compromise the database integrity.
- Analyzed the forgeable requests and identified 25 different request templates.

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ANALYSIS OF COLLECTED DATA

Library	Usage %	LoC	Funcs.	*I/O*	Time (s)
JQuery	81.13%	10,872	428	238	57.54
Bootstrap	38.67%	2,377	55	55	41.07
JQuery UI	27.35%	18,706	320	320	82.33
ReactJS	9.43%	3,318	130	40	39.59
ReactDOM	9.43%	25,148	688	368	81.98
RequireJS	8.49%	1,232	50	50	35.72
AngularJS	5.66%	36,431	852	558	82.92
Analytics	5.66%	20,345	244	233	69.21
Backbone	5.66%	2,096	148	50	38.26
Modernizer	5.66%	834	292	21	34.50
Prototype	5.66%	7,764	266	243	54.10
YUI	4.71%	29,168	2,414	637	149.34
JIT	3.77%	17,163	430	255	69.11
ChartJS	2.83%	16,152	263	253	76,75
Dojo	2.83%	18,937	696	313	63.32
LeafletJS	2.83%	14,080	650	208	62.65
Scriptaculous	2.83%	3,588	97	84	46.11
HammerJS	1.88%	2,643	67	47	37.01
MomentJS	1.88%	4,602	138	138	45.44
ExtJS	1.88%	135,630	2,701	1,135	231.86
Vue	1.88%	11,965	638	288	62.77
YUI History	1.88%	789	20	10	18.41
Bootstrap Growl	0.94%	215	7	7	32.21
Bpmn-Modeler	0.94%	19,139	231	228	65.84
CookiesJS	0.94%	79	3	0	31.29
FlotChartsJS	0.94%	1,267	15	15	42.38
GWT WebStarterKit	0.94%	110	3	2	31.15
Gzip-JS	0.94%	280	4	4	31.87
Handlebars	0.94%	6,726	103	103	50.83
SpinJS	0.94%	190	4	4	31.99
SWFObject	0.94%	729	20	16	33.61
Total		412,575	11,977	5,923	1919.84

Sources	Forgeable	Apps
`DOM.COOKIES`	67	5
`DOM.READ`	12,268	83
`*-STORAGE`	76	8
`DOC.REFERRER`	1	1
`POST-MESSAGE`	8	8
`WIN.NAME`	1	1
`WIN.LOC`	280	12
Total forgeable	12,701	87
Non-reachable code	36,665	101
Total	49,366	106

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ANALYSIS OF FORGEABLE REQUESTS

- SuiteCRM and SugarCRM → violate the server's integrity 115/38
- Neos → violate the server's integrity 115/8
- Kibana → violate the server's integrity 115/1
- Modx → violate the server's integrity 115/20
- Odoo → violate the server's integrity 115/1
- Shopware → violate the server's integrity 115/20

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LIMITATIONS AND FUTURE SCOPE

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LIMITATIONS

- Static analysis tools used for the construction of the property graph.
- Checking real time vulnerability is difficult in this case.
- Crawling can not give 100 % code coverage

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FUTURE WORK OF THIS PAPER

- In future need to include dynamic analysis tools for the construction of the property graph.
- Improve the efficiency of Crawling mechanism
- Need to include additional classes for vulnerability check.

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CONCLUSION

JAW is the new concept of HPG, a canonical, static-dynamic model for clientside JavaScript programs.

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OBSERVATION

1. JAW entire model can be more efficient if we could use dynamic tools for experimental test.

2. JAW does not rely on a specific feature of JavaScript hence the methodology can be used for different programming language.

3. Need to include additional vulnerability classes.

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THANK YOU

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