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Security & Privacy

Hidden Risk of Unpopularity in Open Source

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2021 Fall Technical Forum
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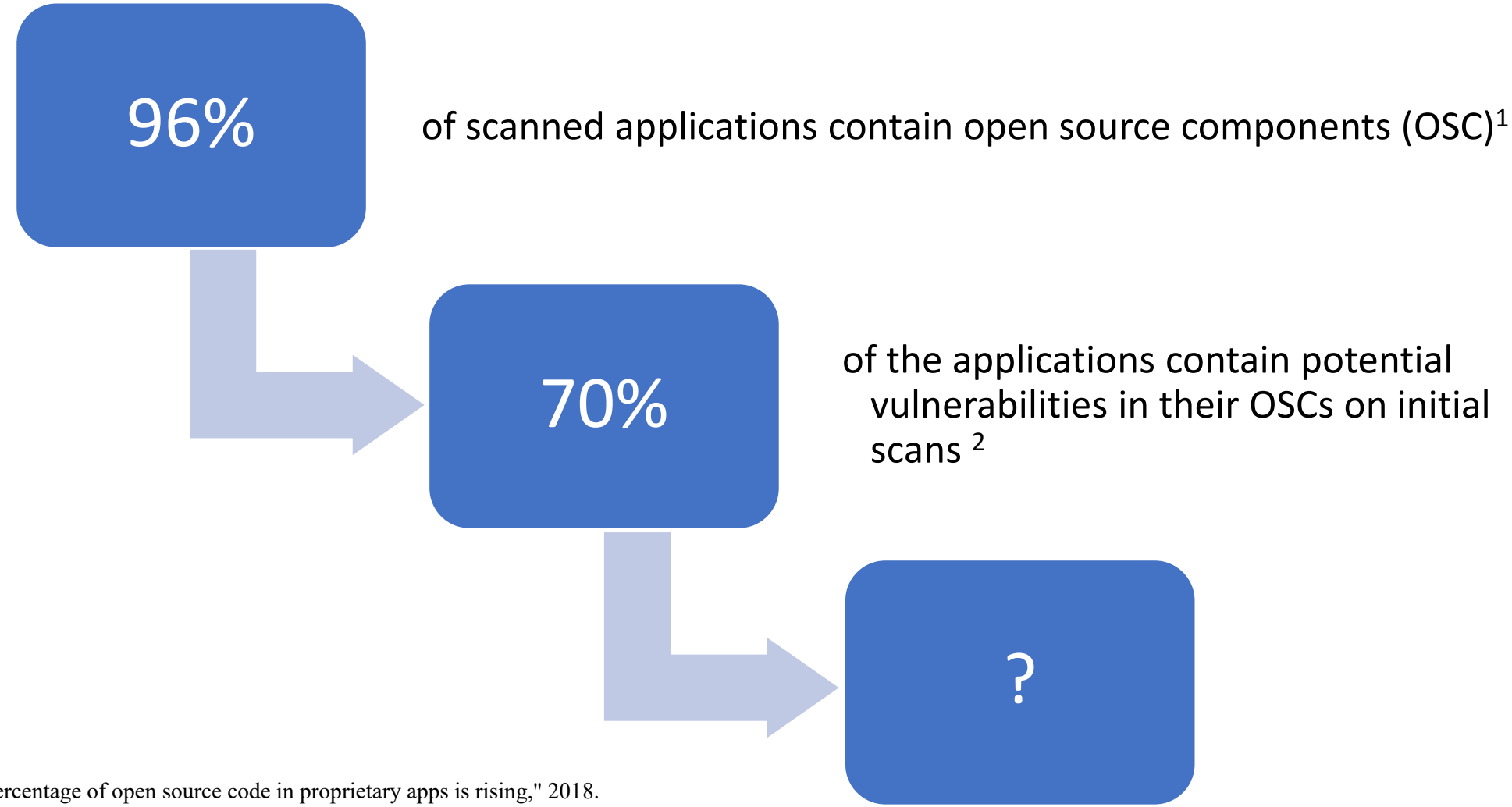


1. Z. Zorz, "The percentage of open source code in proprietary apps is rising," 2018.
2. "State of Software Security v11," Veracode, 2020.

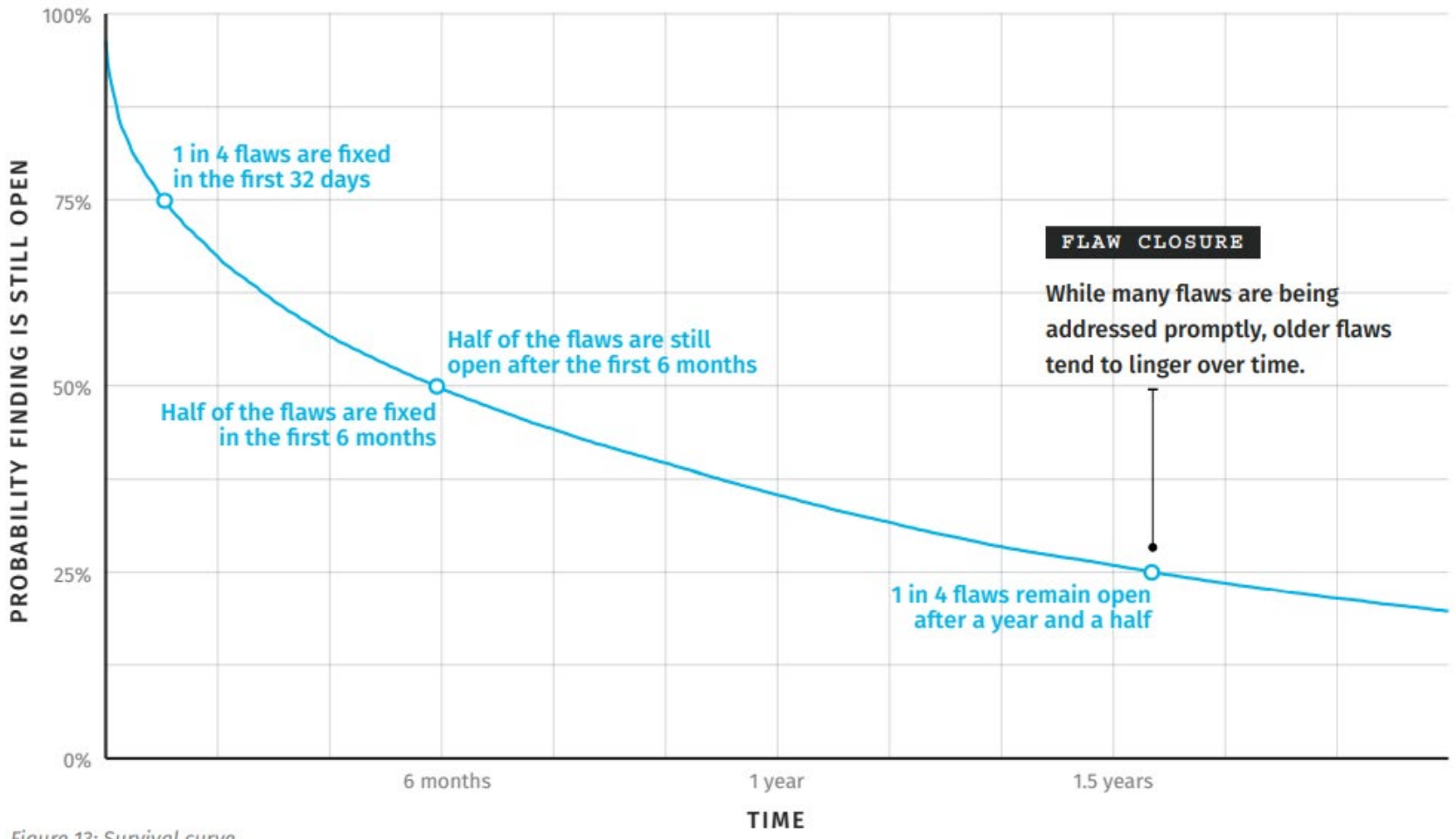


Figure 13: Survival curve of flaw closure

"State of Software Security: Open Source Edition," Veracode, 2020.

Independent Researchers

- In-depth analysis from different angles.
- Focus on popular OSC. Does not leave time for us to patch.

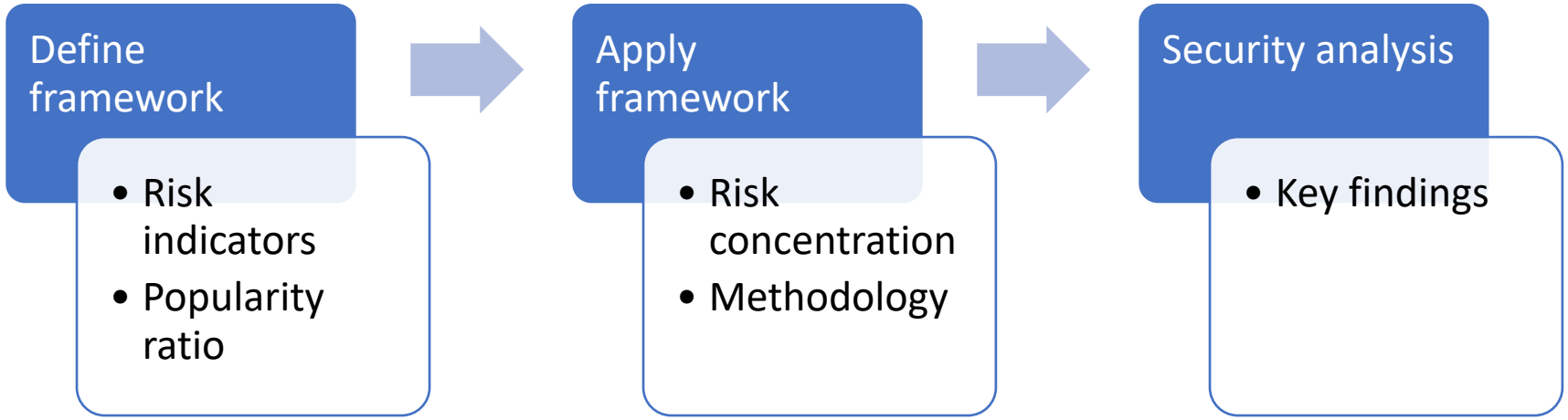
Company Policy

- Analysis software that check for existing vulnerabilities.
- Limit to a list of OSCs may not be practical. What about undiscovered vulnerabilities?

Targeted Analysis

- Verify exploits and give appropriate response.
- Who? How? At what cost?

How should we address the potential hidden security risk of the open-source libraries?



Risk Indicators

The many direct and indirect indicators of security risks can be broadly categorized as

Security Status

- Reported vulnerabilities from CVE and NVD
- Severity of vulnerabilities based on CVSS
- Security of the language
- Typical time to remediation
- Number of open issues

Code Characteristics

- Lines of code
- Complexity of the code
- Number of versions
- Time of creation
- Number of libraries they use
- Where/how it is used

Popularity

- Number of contributors
- Number of Github stars
- Number of forks and pull requests
- Number of subscribers
- Number of downloads
- Number of dependencies

So much information….so many OSCs…

Popularity Ratio

Popularity ranking of OSCs is based on the ratio of popularity for each OSC:

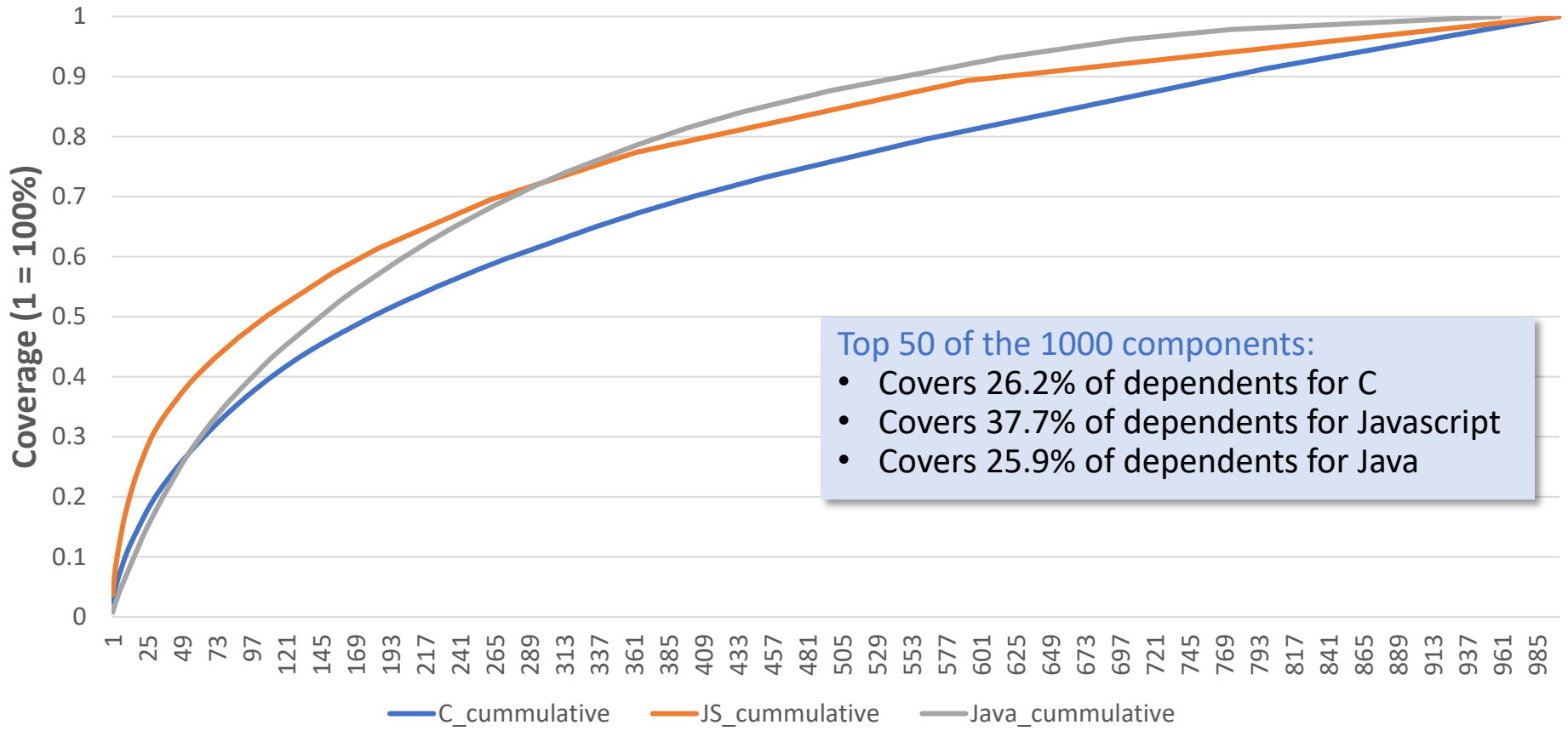
$$Relative\ Popularity\ ratio = \frac{Internal\ popularity}{External\ popularity}$$

Internal popularity = number of dependents

External popularity = average of

- Dependents
- Weekly downloads
- Github stars

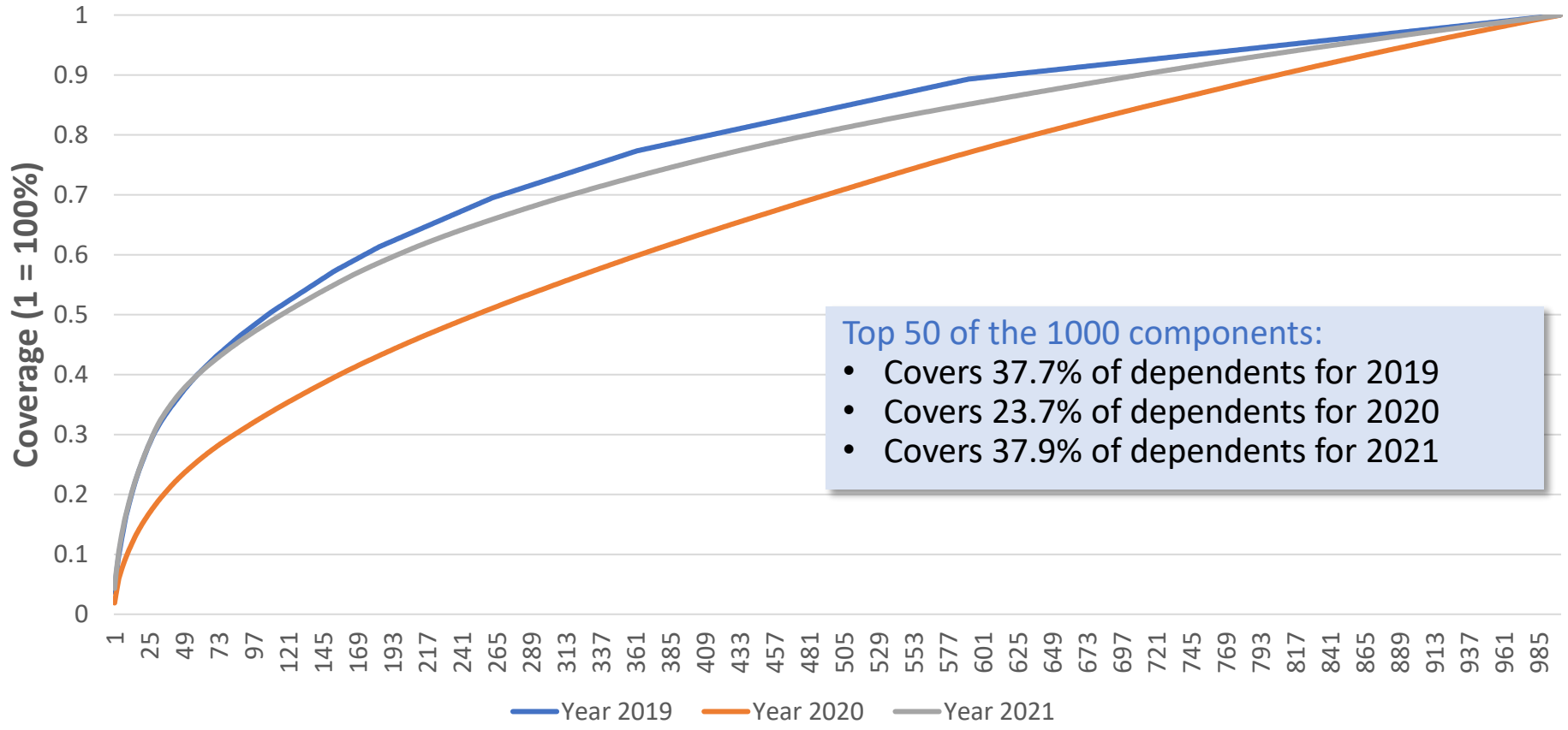
Coverage for top 3 languages



Top 50 of the 1000 components:

- Covers 26.2% of dependents for C
- Covers 37.7% of dependents for Javascript
- Covers 25.9% of dependents for Java

Coverage over 3 years for JavaScript



Top 50 of the 1000 components:

- Covers 37.7% of dependents for 2019
- Covers 23.7% of dependents for 2020
- Covers 37.9% of dependents for 2021

Focus of analysis

Language

- JavaScript

Coverage

- Top 50

Targeted analysis

- Referencing OWASP top 10 and SANS top 25
- Source code flaws
- Server side flaws

Method

Collect internal info

- SCA
- Name and number of dependents
- Top 100 JavaScript

Collect external info

- Npm repo (weekly downloads, number of dependents)
- Github (number of stars)

Identify targets

- Calculate relative popularity of each OSCs
- Rank accordingly and cut down to top 50

Third party analysis

- Comcast Center of Excellence for Security Innovation at UConn
- Code injection

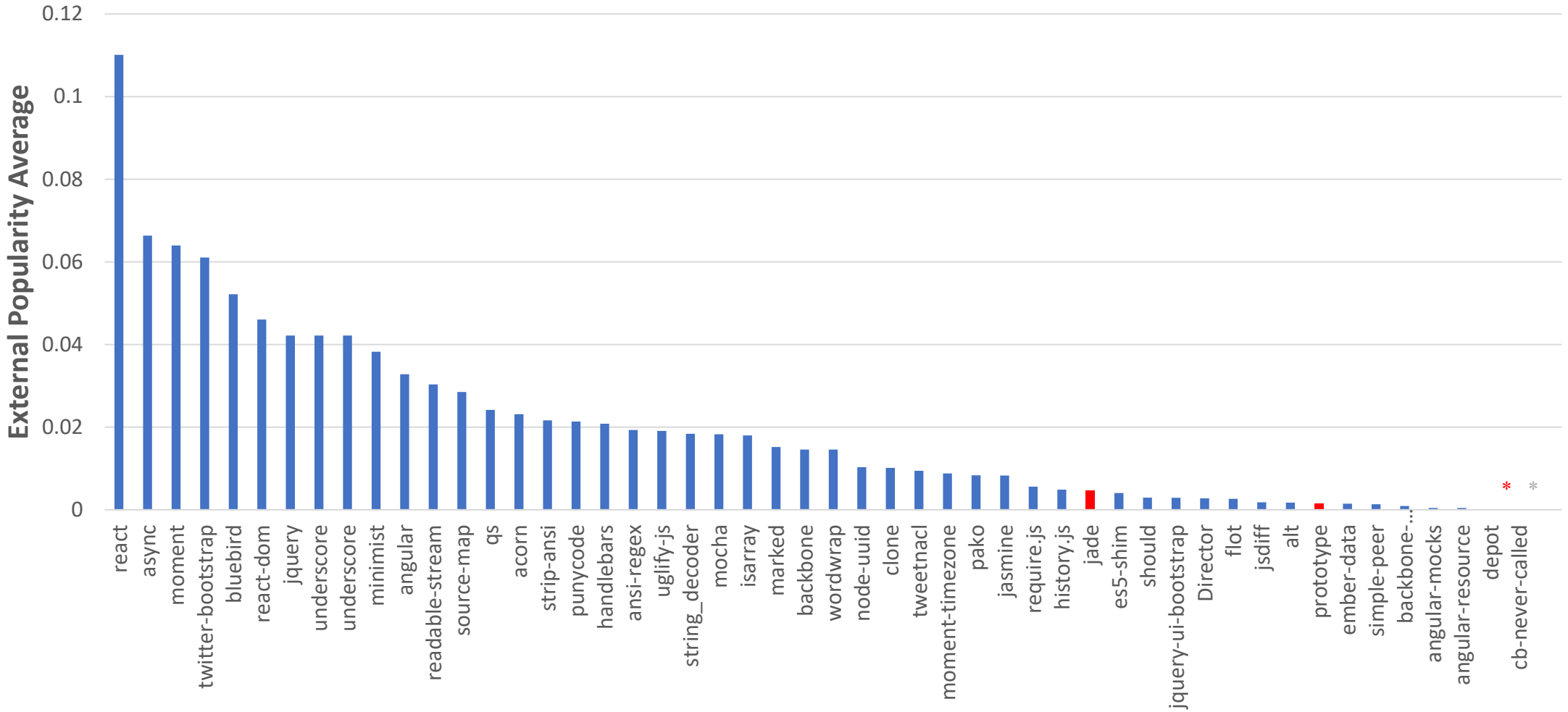
Verification

- Undiscovered
- Exploitable

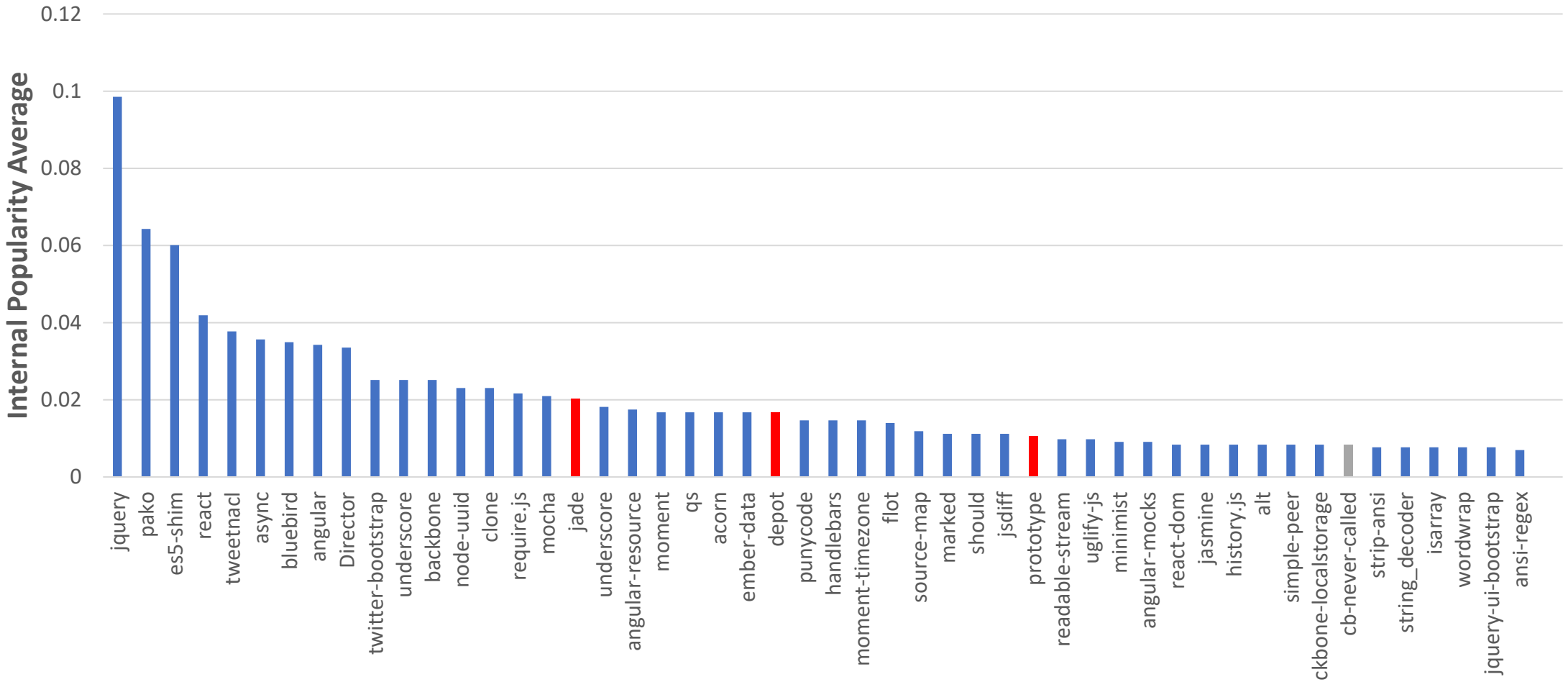
3 exploitable OSC

1 deprecated OSC

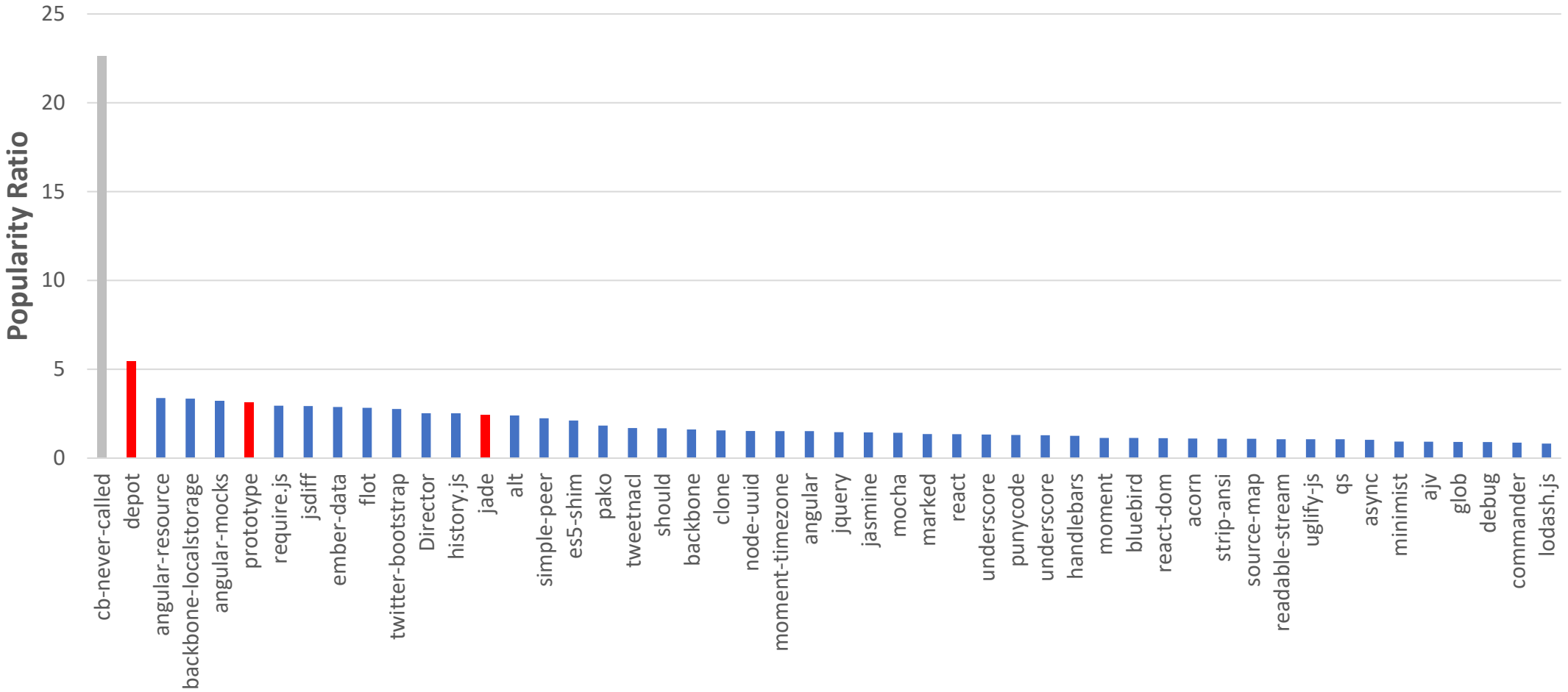
Case Study



Case Study



Case Study



Conclusion

What did we learn?

- There is a hidden risk in unpopular OSCs
- Some of them are easy to fix

Where to start?

- Take inventory of OSCs using SCA to identify existing vulnerabilities and patches
- Identify areas of concentrated risk

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Thank You!

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