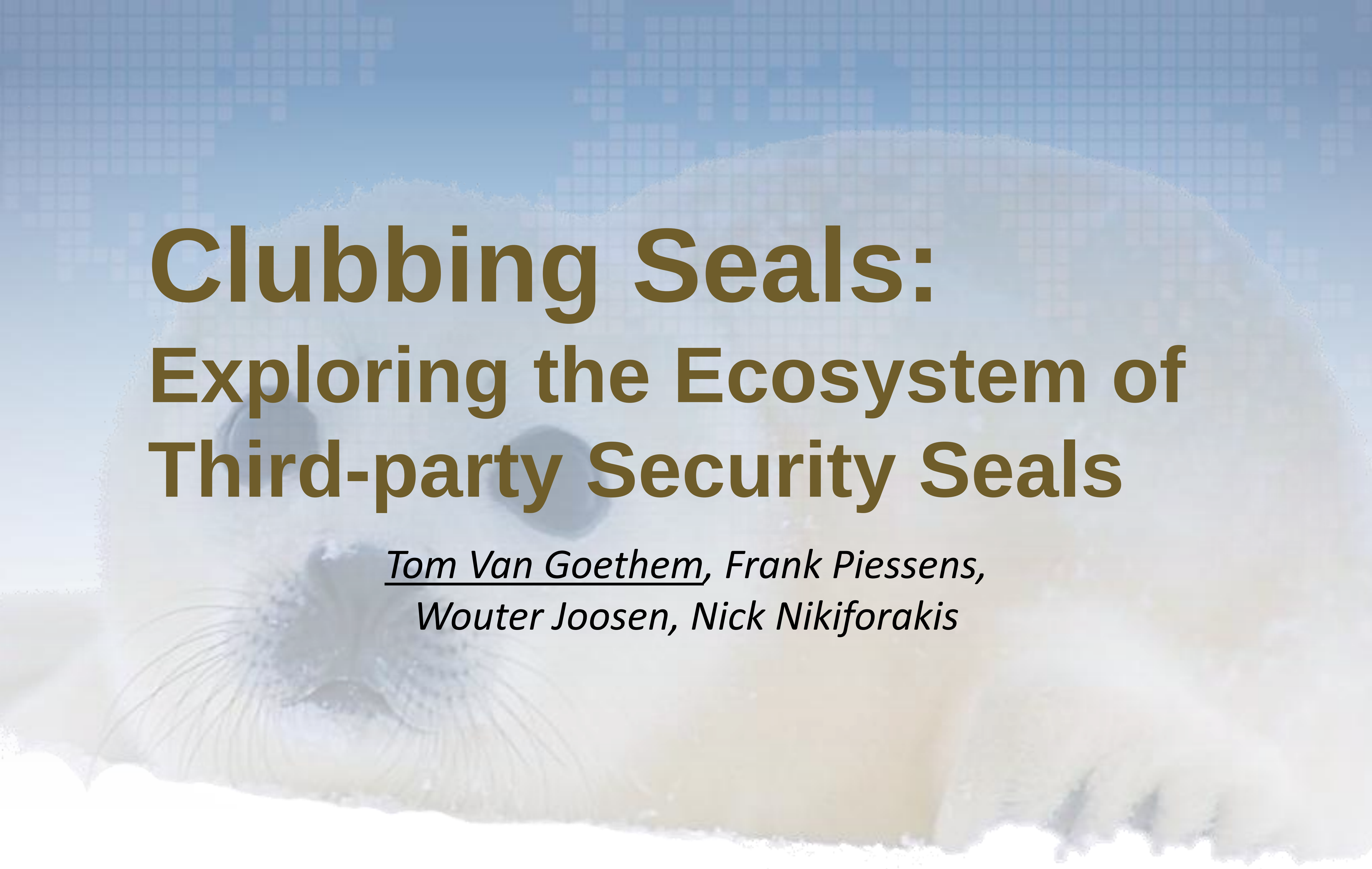
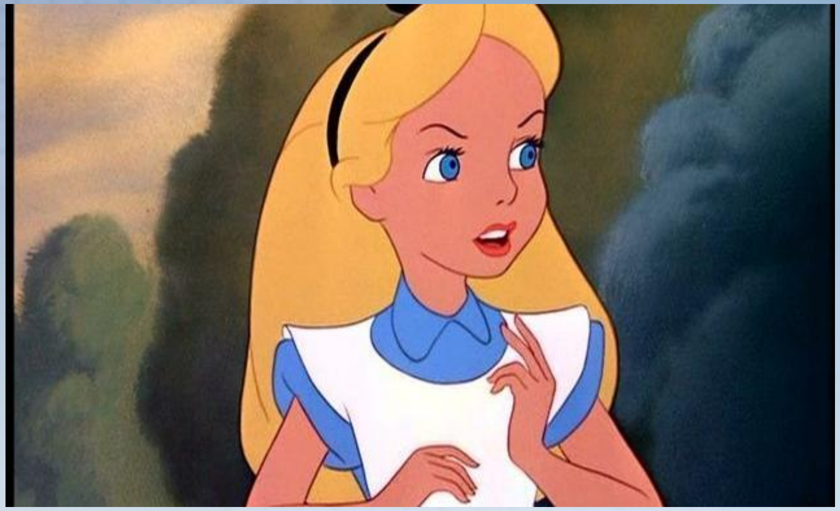


Clubbing Seals:

Exploring the Ecosystem of Third-party Security Seals

Tom Van Goethem, Frank Piessens,
Wouter Joosen, Nick Nikiforakis

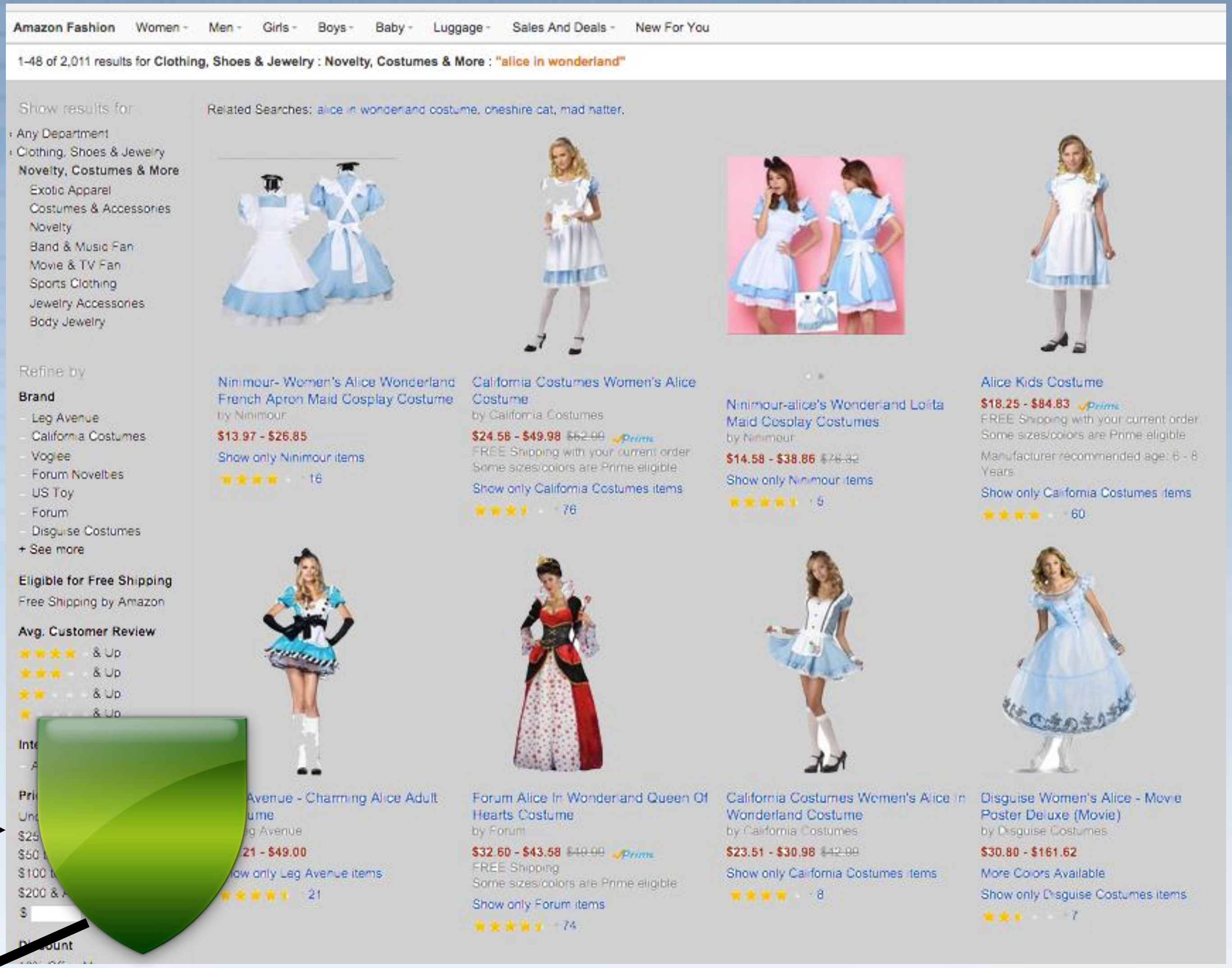
OWASP
Open Web Application
Security Project



Security Conscious Alice

Enter credentials?

Security is OK?



1-48 of 2,011 results for **Clothing, Shoes & Jewelry : Novelty, Costumes & More : "alice in wonderland"**

Show results for

- Any Department
- Clothing, Shoes & Jewelry

Novelty, Costumes & More

Exotic Apparel
Costumes & Accessories
Novelty
Band & Music Fan
Movie & TV Fan
Sports Clothing
Jewelry Accessories
Body Jewelry

Refine by

Brand

Leg Avenue
California Costumes
Voglee
Forum Novelties
US Toy
Forum
Disguise Costumes
+ See more

Eligible for Free Shipping

Free Shipping by Amazon

Avg. Customer Review

★★★★ & Up
★★★ & Up
★★ & Up
★ & Up

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Discount

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Show only Ninimour items
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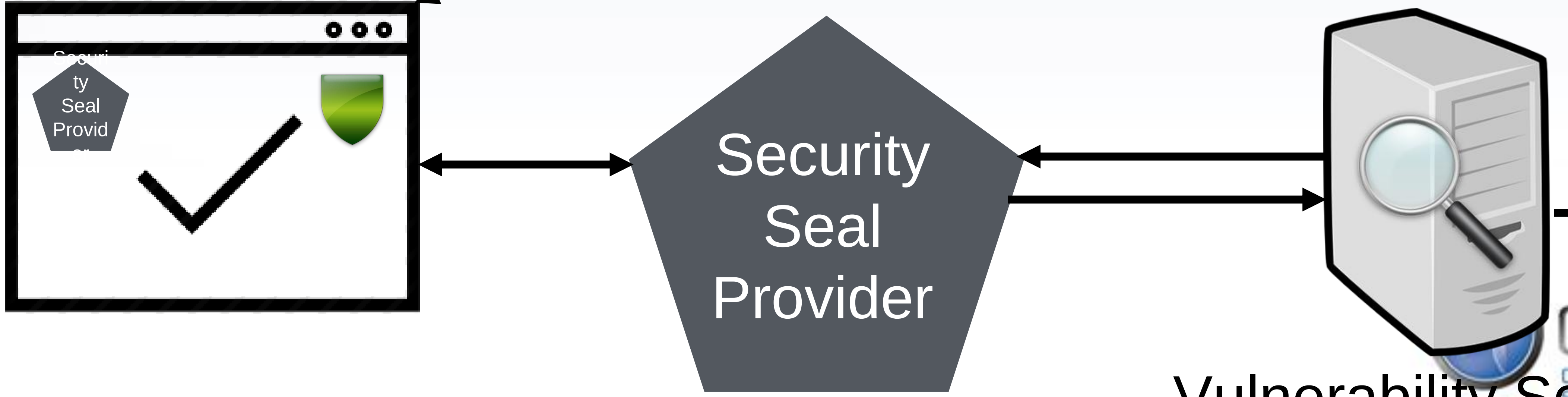
Webshop

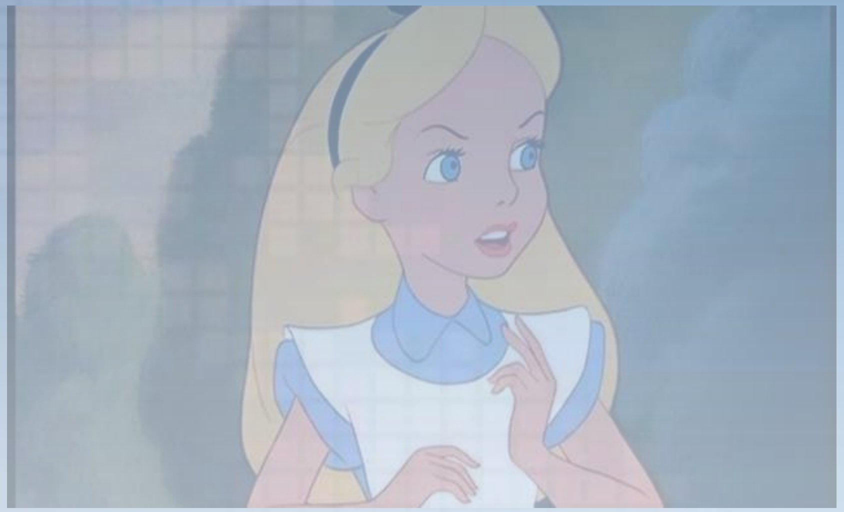


Security Seal Provider

Vulnerability Scanner

Outline

- Ecosystem entities
- Security evaluation
- Attacks



Security Conscious Alice

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- Forum
- Disguise Costumes
- + See more

Eligible for Free Shipping

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Avg. Customer Review

★★★★ & Up
★★★ & Up
★★ & Up
★ & Up

International Shipping

AmazonGlobal Eligible

Price

Under $25
$25 to $50
$50 to $100
$100 to $200
$200 & Above
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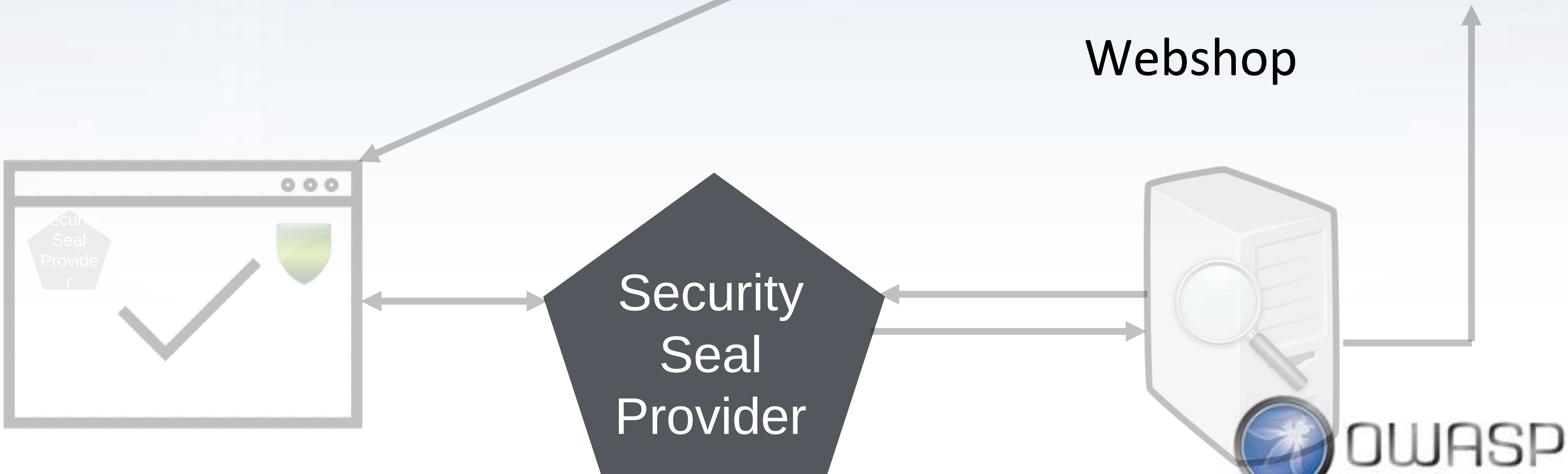
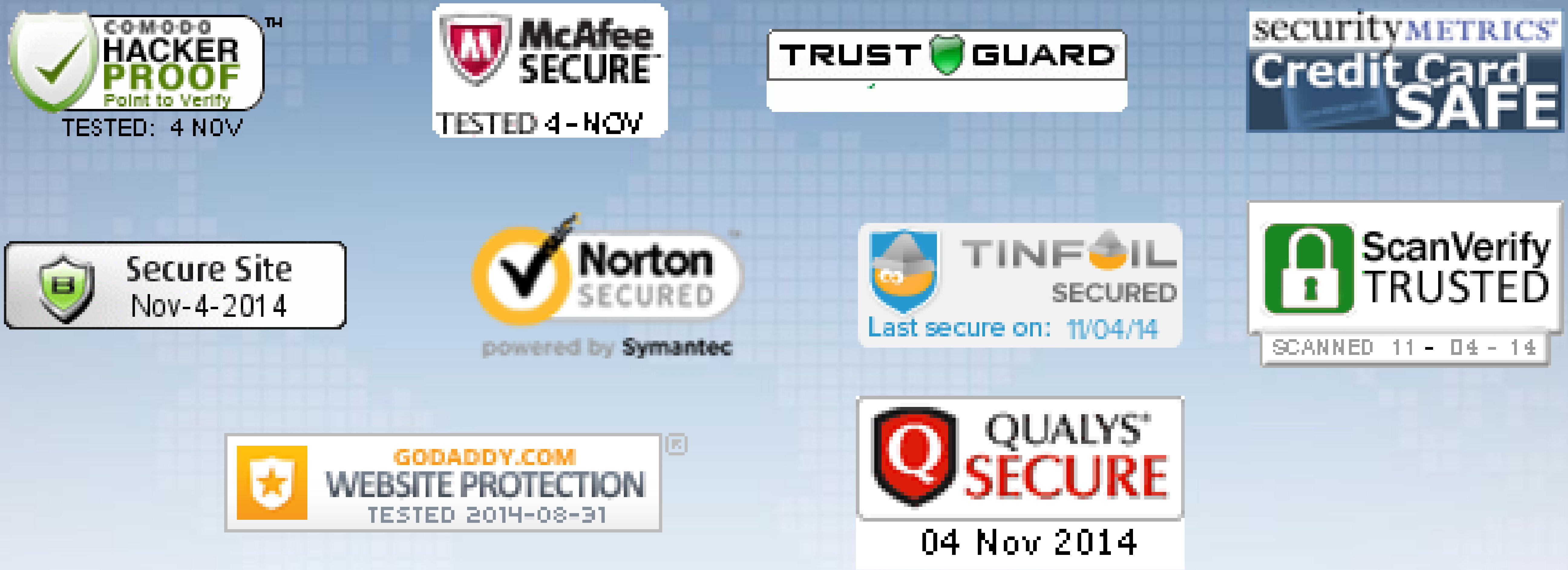
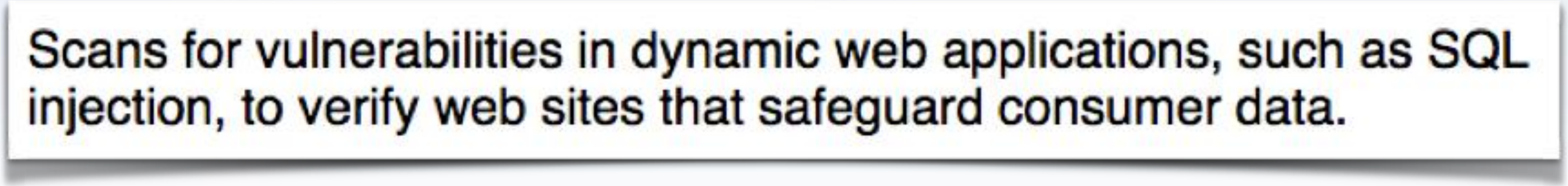
Webshop

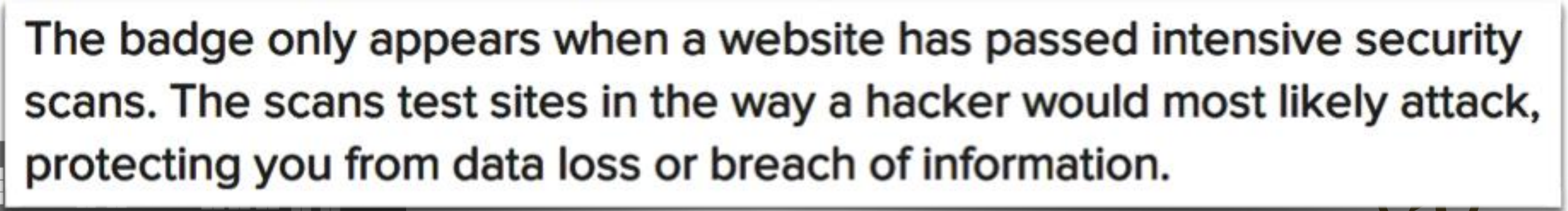


Security Seal Provider

Vulnerability Scanner




Scans for vulnerabilities in dynamic web applications, such as SQL injection, to verify web sites that safeguard consumer data.

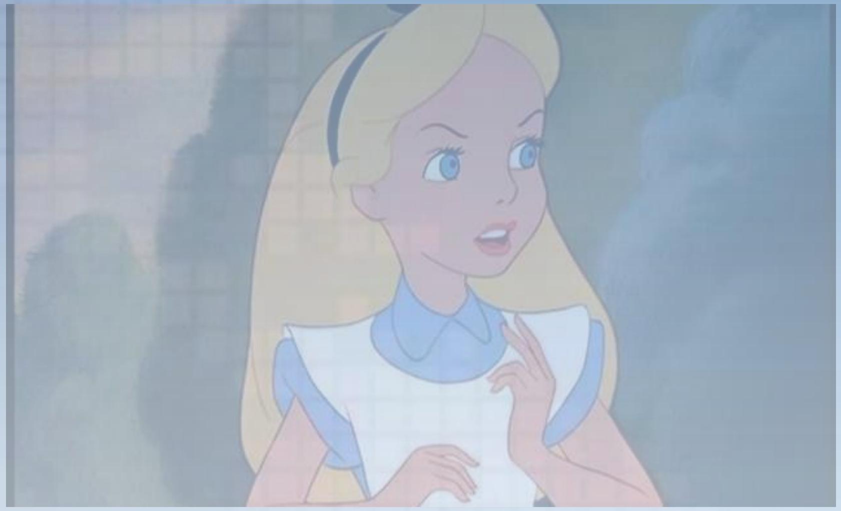

The badge only appears when a website has passed intensive security scans. The scans test sites in the way a hacker would most likely attack, protecting you from data loss or breach of information.

Security Seal Providers

- 10 seal providers evaluated
- Large security companies - startups providing security seals
- Yearly cost: $84 - $2,388 per year
- All offer vulnerability scan
- Half offer malware scan

Security Seal Providers

- Differences in offered security services
  - Server-side file access (FTP)
  - Server-side authentication (login-form)
- Differences in security seal visibility
  - Vulnerability may lead to invisible seal
  - Grace period (0 days - 1 week)



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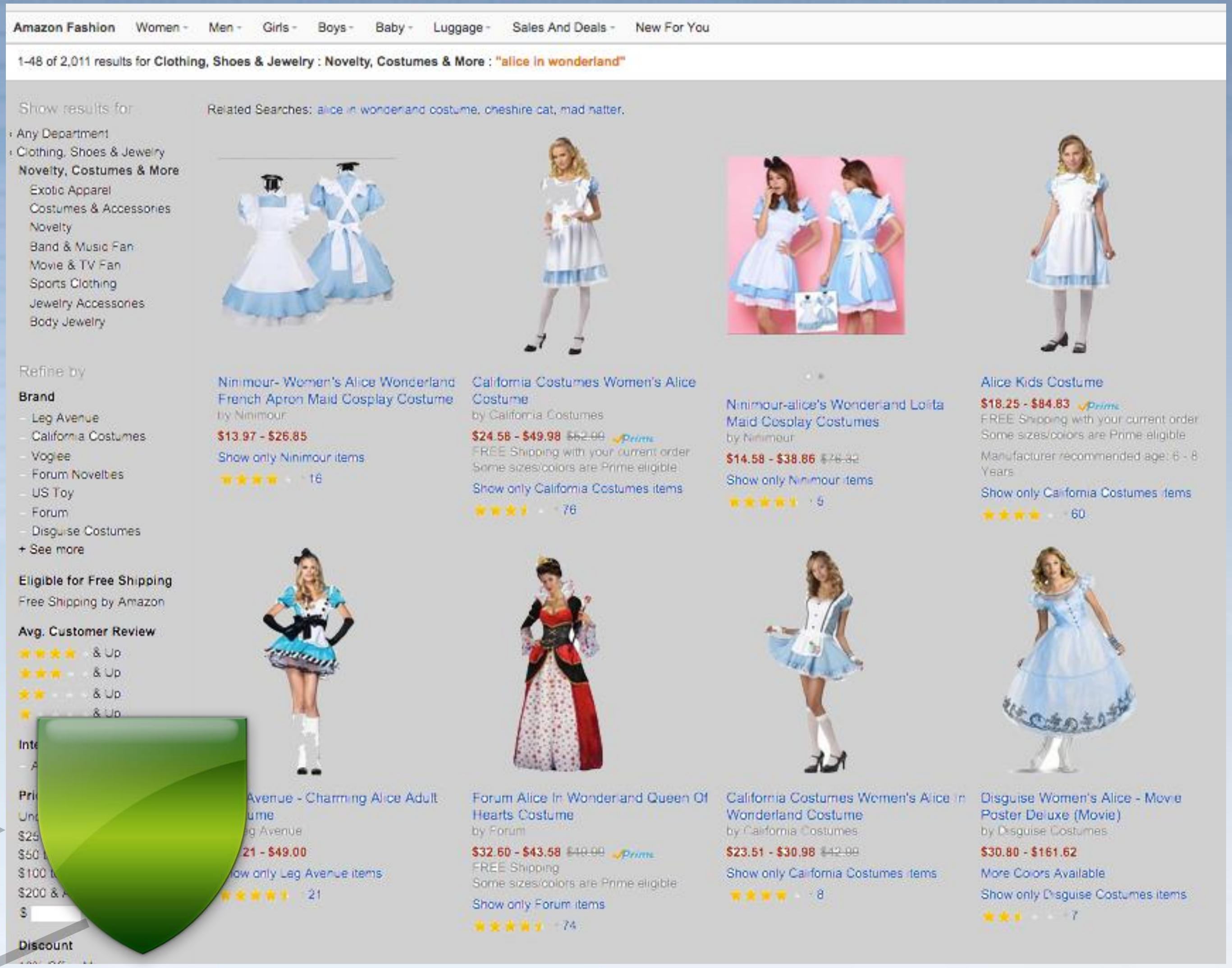

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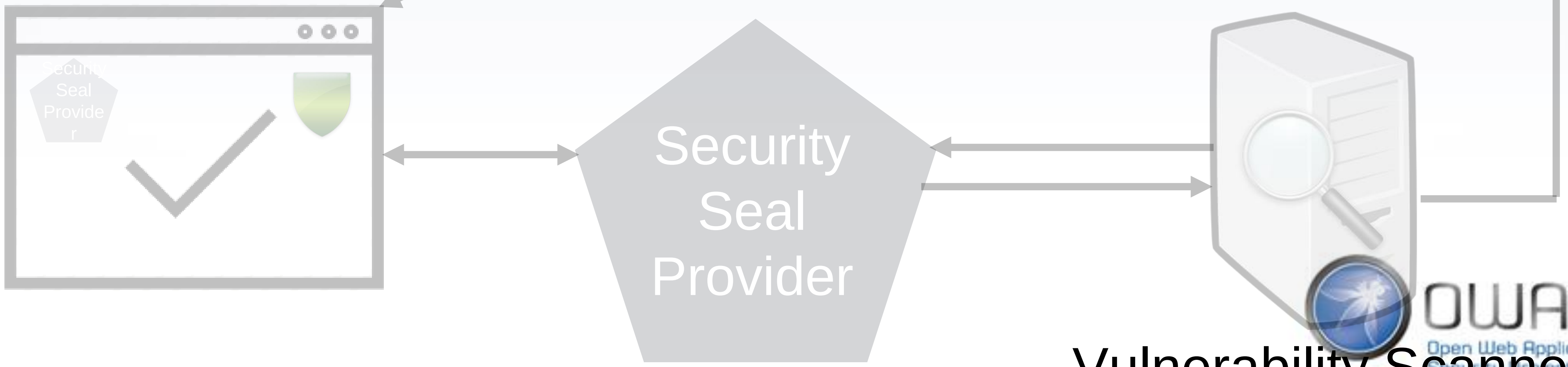
Webshop



Vulnerability Scanner

Security Seal Customers

- Found by crawling Alexa top 1M
  - Security seal images, links
- Google snippets
  - site:scanverify.com/siteverify.php
- 8,302 websites (~74% from Alexa top 1M)
- Mainly e-commerce

Security Evaluation

- Should Alice trust seal providers?
- Security evaluation on various dimensions
  - Comparison to non-sealed websites
  - Manual penetration test
  - Vulnerable webshop experiment

Comparison to non-sealed websites

- Sealed sites interested in security → implement security mechanisms?
- Compare with equivalent websites
  - Same category
  - Similar Alexa ranking (10 ranks above or below)
- Compare presence of security indicators
  - HSTS, Secure/HttpOnly cookies, CSP, XFO, ...

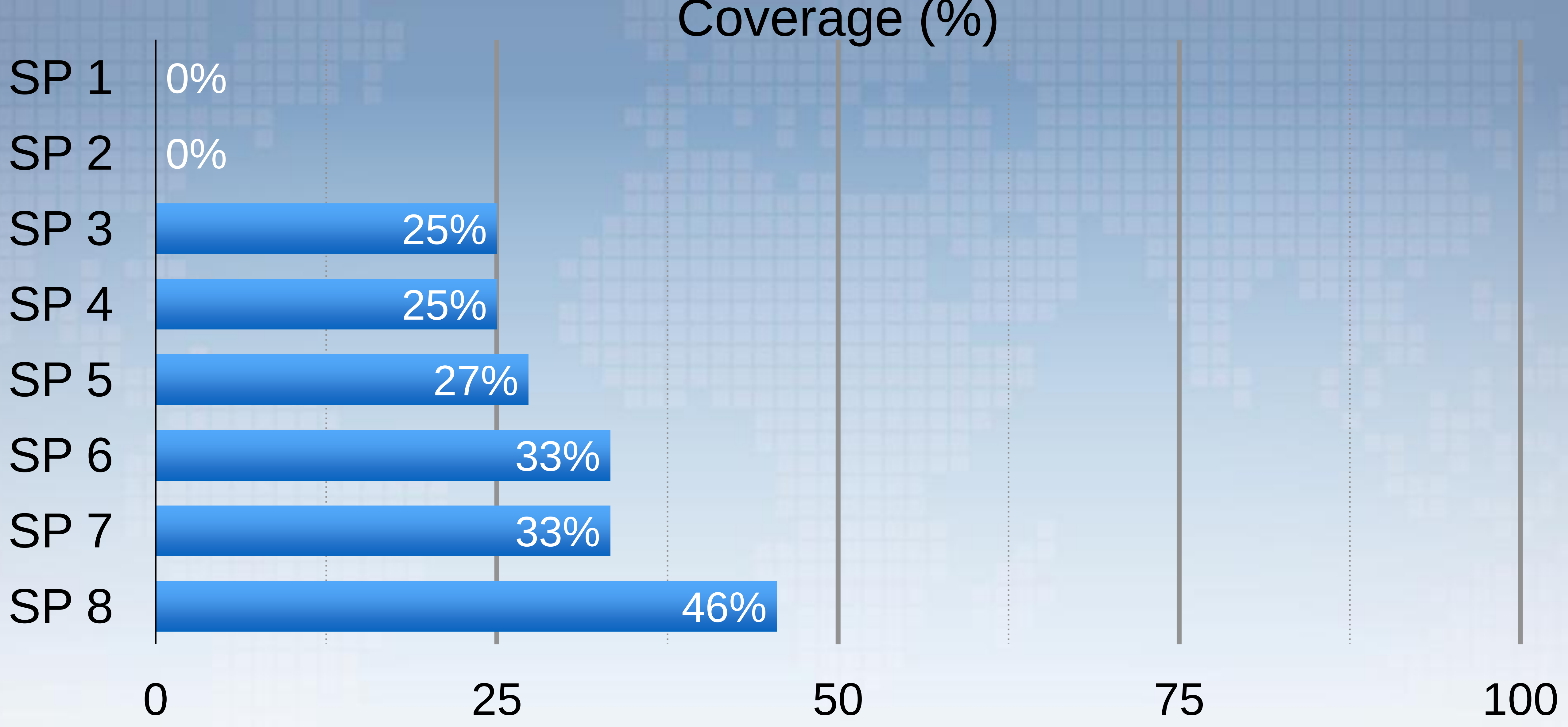
Security Mechanism	Sites w/ Seal (%)	Sites w/o Seal (%)	Significantly different (p-value)
HSTS	1.05	1.06	✗ (1.00)
Secure Cookies	1.83	0.42	✗ (0.06)
SSL Stripping	15.45	15.64	✗ (0.99)
X-Frame Options	3.71	**5.14**	✓ (0.02)
HttpOnly Cookies	**42.27**	29.98	✓ (<0.01)
Content-Security-Policy	0.00	0.00	– (NA)
Anti-CSRF tokens	6.39	**11.89**	✓ (<0.01)
X-Content-Type-Options	0.00	0.00	– (NA)
iframe sandbox	0.18	0.04	✗ (0.37)

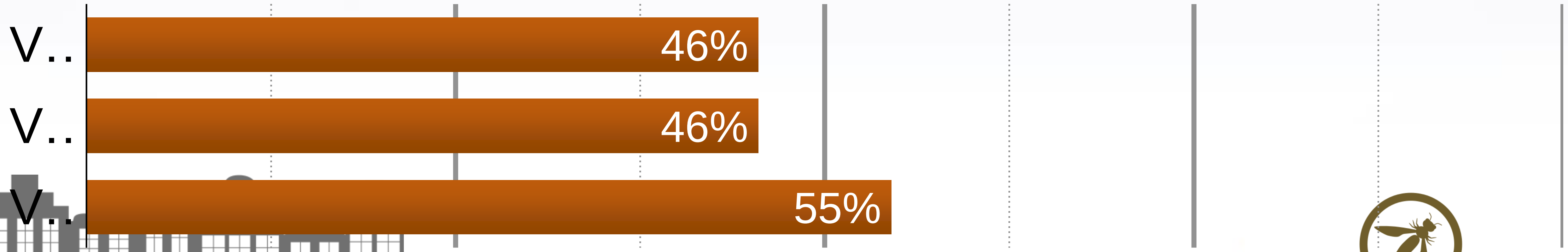
Manual Penetration Test

- Security scan by seal provider → no easily discoverable vulnerabilities?
- Contact 1,000 sealed websites
  - Only 9 agreed to penetration test
- During 8 hours, check for SQL injection, XSS, CSRF, ...
- 7 out of 9 websites vulnerable
  - 6 websites contain easily discoverable vulnerabilities (XSS, textbook SQL injection)

Vulnerable webshop experiment

- Evaluate accuracy of tools used by seal providers
- Setup webshop with severe vulnerabilities
  - Reflect realistic website
  - Outdated PrestaShop
  - Add 12 vulnerabilities spanning various classes
    - XSS, SQL Injection, sensitive files, ...


Coverage (%)
SP 1
SP 2
SP 3
SP 4
SP 5
SP 6
SP 7
SP 8
0%
0%
25%
25%
27%
33%
33%
46%
0
25
50
75
100


V..
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46%
46%
55%

Attacks

- Security seals are part of an attacker's toolset
  - Find vulnerable websites
  - Identify vulnerability
  - Improve phishing campaigns

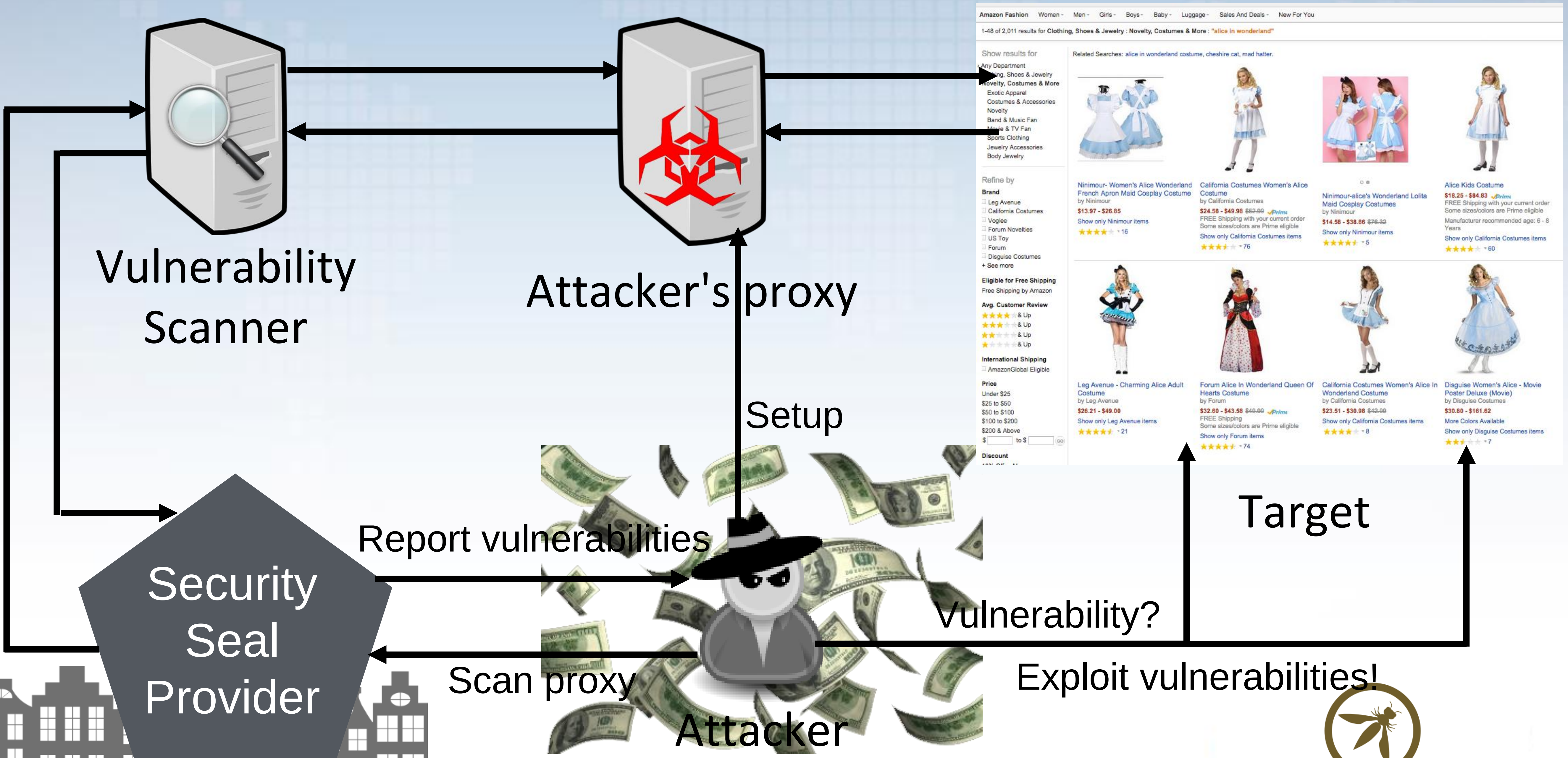
Attacks

Find vulnerable websites

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Website 1	🛡	🛡	🛡	🛡	🛡	🛡	🛡
Website 2	🛡	🛡	🛡	🛡	🛡	🛡	
Website 3	🛡			🛡	🛡	🛡	🛡
Website 4	🛡	🛡	🛡	🛡			
Website 5	🛡	🛡	🛡	🛡	🛡		
Website 6	🛡	🛡	🛡	🛡	🛡	🛡	🛡
Website 7	🛡	🛡	🛡	🛡	🛡	🛡	🛡

Attacks

Identify vulnerabilities



Vulnerability Scanner

Attacker's proxy

Setup

Security Seal Provider

Report vulnerabilities

Scan proxy

Attacker

Target

Vulnerability?

Exploit vulnerabilities!

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International Shipping
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Price
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$25 to $50
$50 to $100
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$200 & Above
$ □ to $ □ GO

Discount

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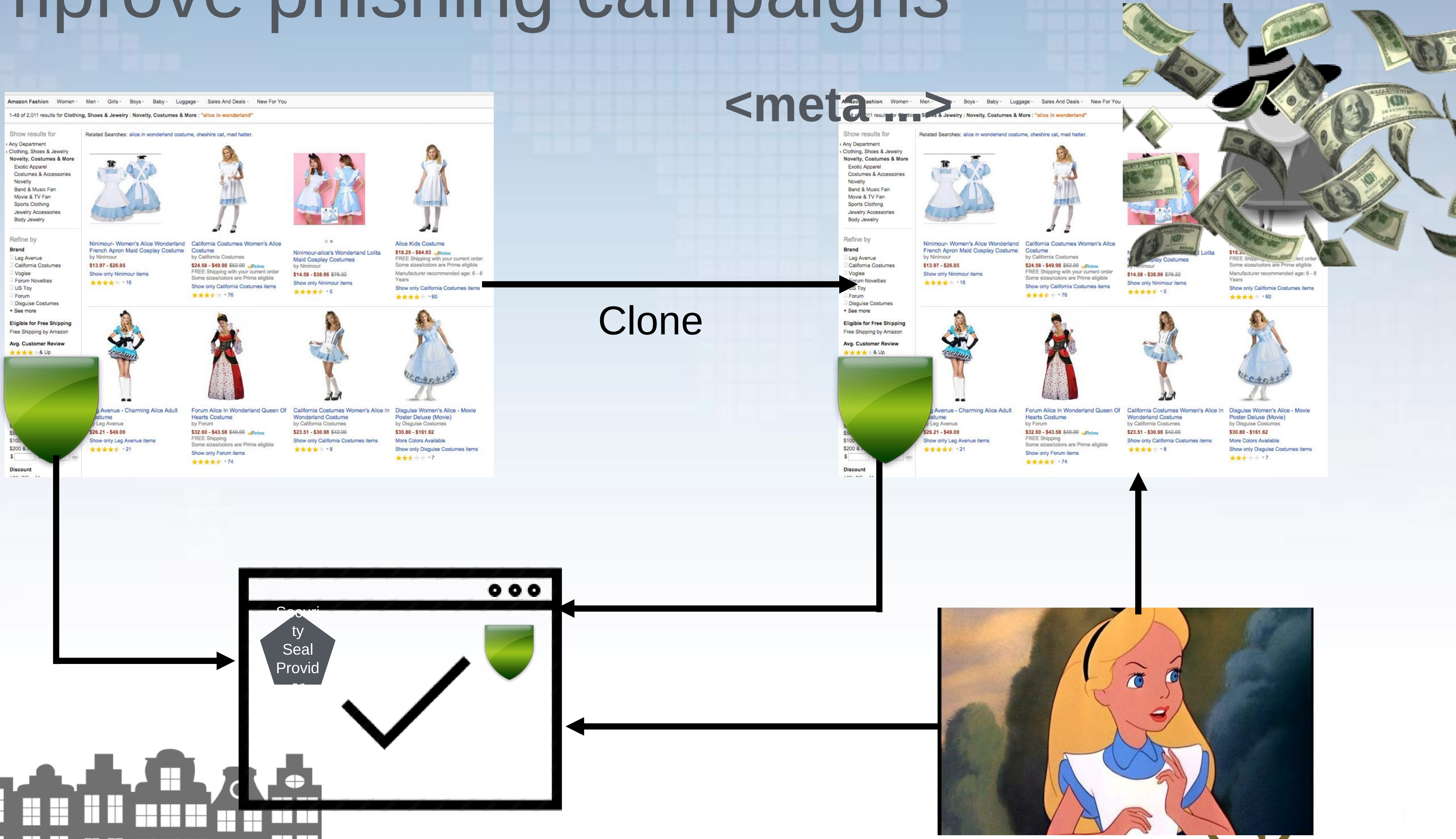
Attacks

Improve phishing campaigns

- Include security seal on phishing page
  - Hide `Referer` header
- Leads to increased credibility on phishing page

Attacks

Improve phishing campaigns



Conclusion

- Security seals often used on webshops
- Presence of seal not trustworthy
  - Sealed sites not more secure than non-sealed
  - Vulnerability scanners insufficient
- Various attacks on security seals
  - Sealed sites = valuable target for attackers