Your Browser Wears No Clothes

Why Fully Patched Browsers Remain Vulnerable

Michael Sutton

VP, Security Research

ZSCALER™

Who Am I?

Company

- Zscaler – SaaS solution for web security
- VP, Security Research

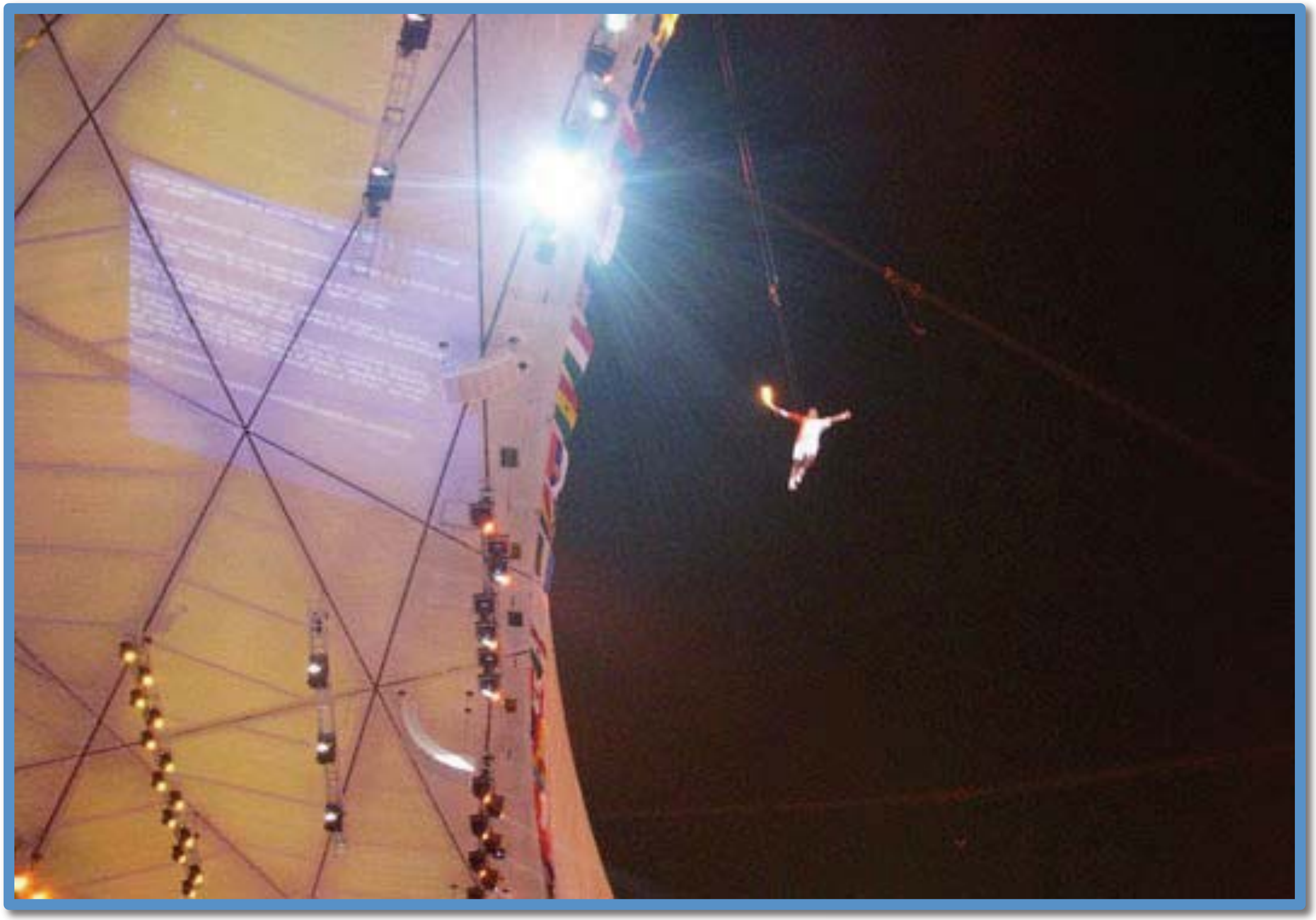
Background

- SPI Dynamics – acquired by HP
- iDefense – acquired by VeriSign

Research

- Web security
- Client-side vulnerabilities
- Fuzzing

BSoD – Beijing Olympics



Overview

Background

Attacks

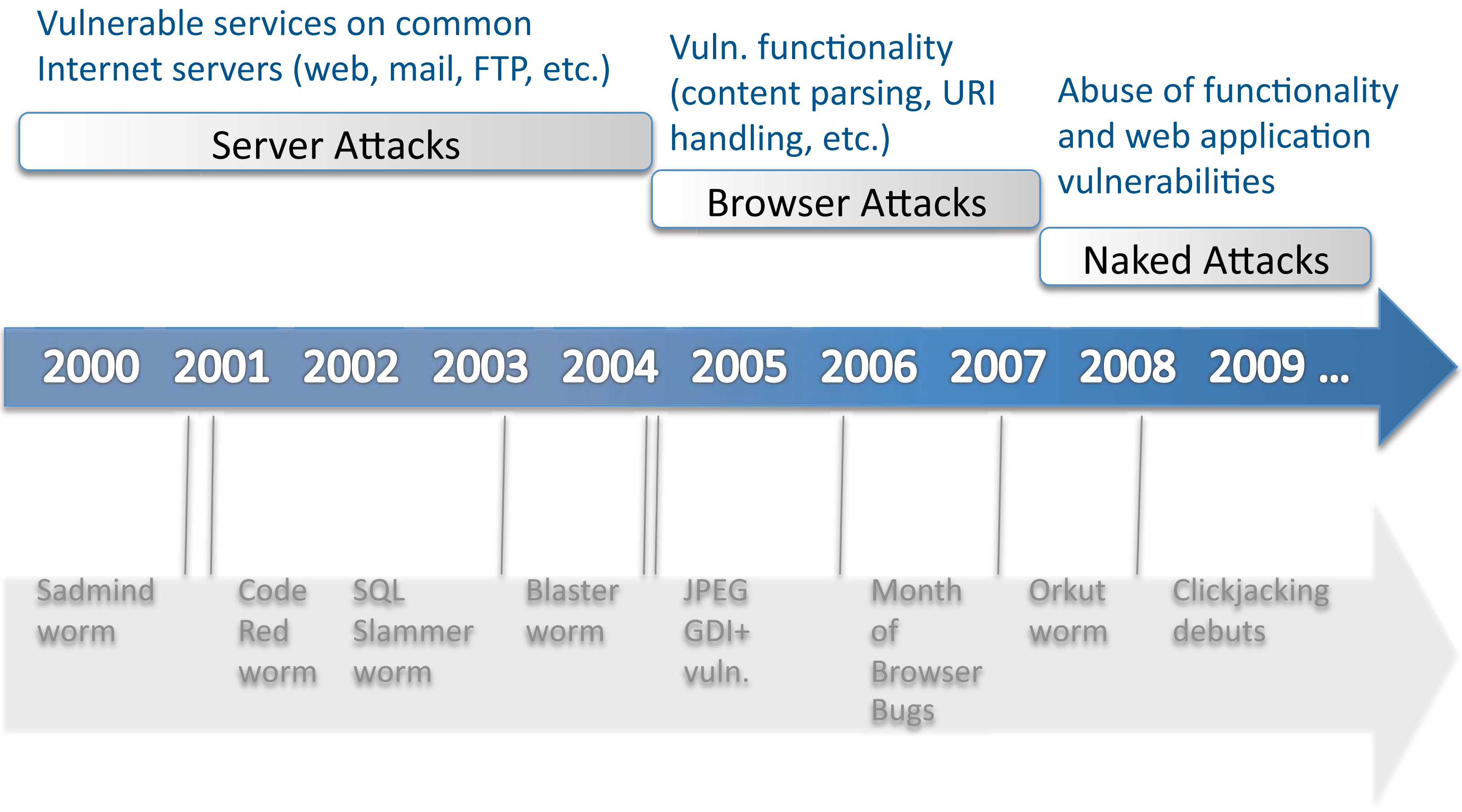
- XSS
- Clickjacking

Challenges

Defense

Future

Evolution of Attacks



Vulnerable services on common Internet servers (web, mail, FTP, etc.)

Server Attacks

Vuln. functionality (content parsing, URI handling, etc.)

Browser Attacks

Abuse of functionality and web application vulnerabilities

Naked Attacks

Sadmind worm

Code Red worm

SQL Slammer worm

Blaster worm

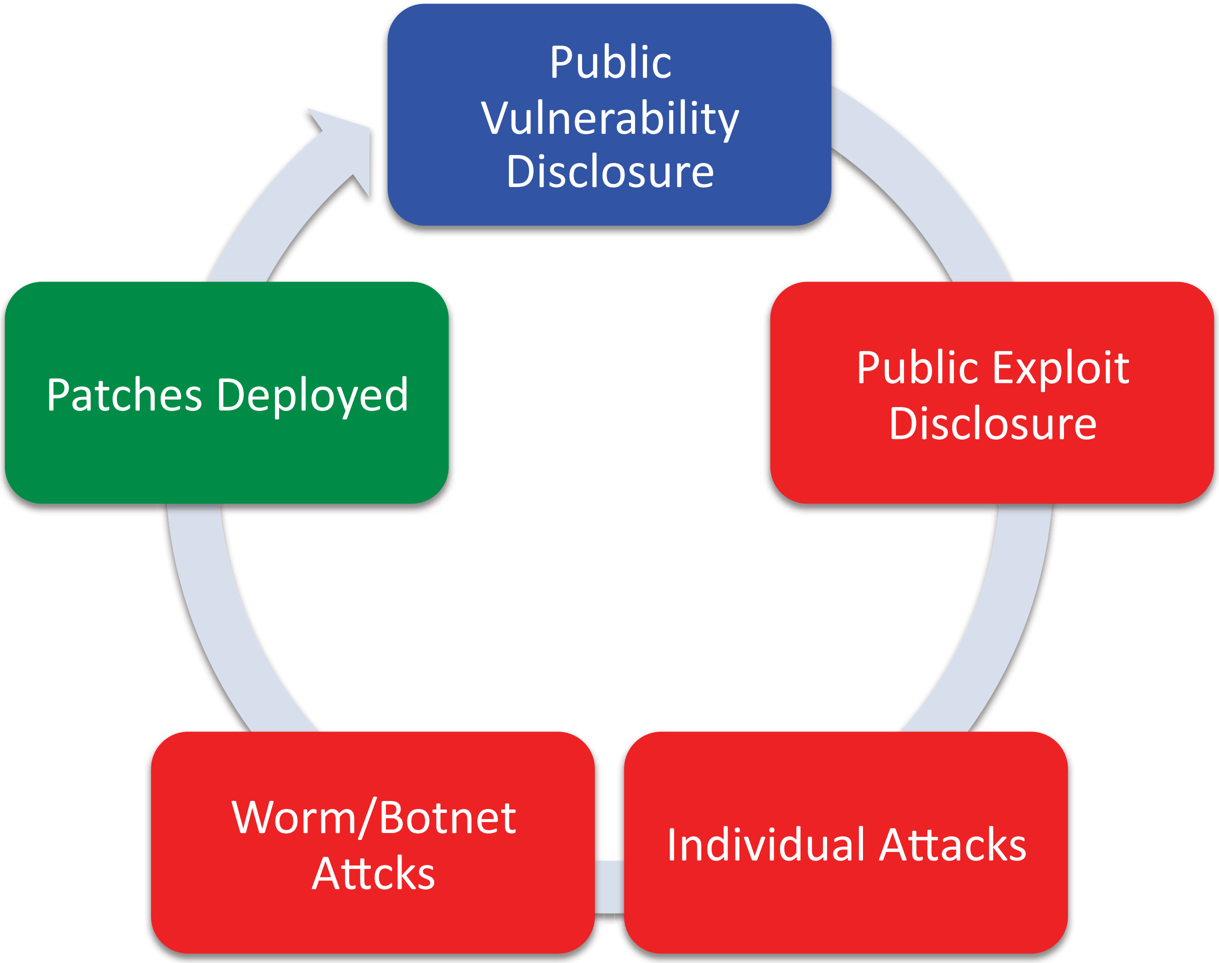
JPEG GDI+ vuln.

Month of Browser Bugs

Orkut worm

Clickjacking debuts

Typical Attack Cycle



Public Vulnerability Disclosure

Public Exploit Disclosure

Individual Attacks

Worm/Botnet Attcks

Patches Deployed

Drivers of Change

Enterprises

- Shrinking patch windows
- Focus on DMZ protection

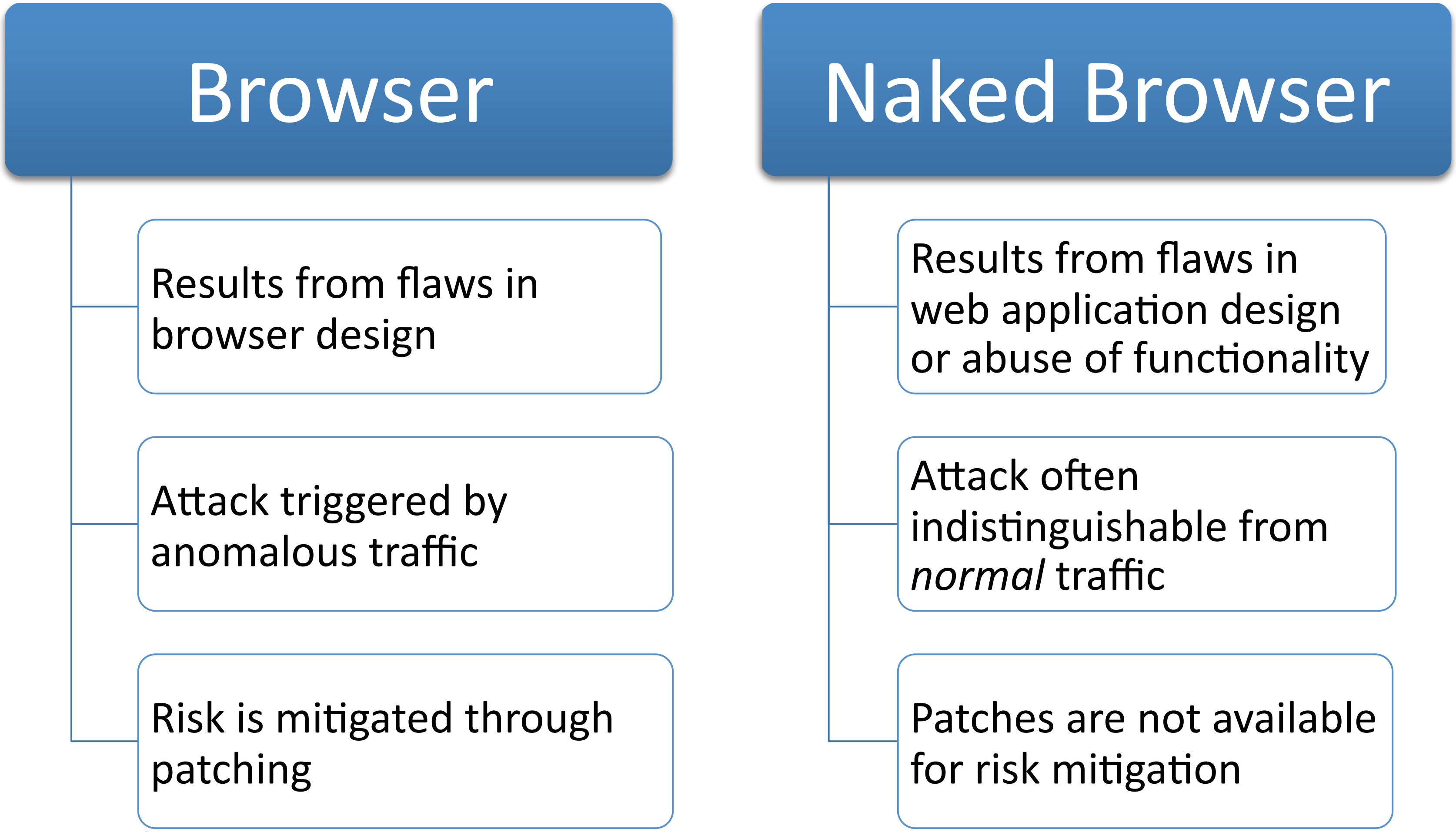
Vendors

- Security response teams
- Secure coding practices

Technology

- Increasingly complex web applications
- Development platforms streamline development
- Rapid pace of new web technologies

Browser Attacks vs. Naked Browser Attacks



Browser

- Results from flaws in browser design
- Attack triggered by anomalous traffic
- Risk is mitigated through patching

Naked Browser

- Results from flaws in web application design or abuse of functionality
- Attack often indistinguishable from *normal* traffic
- Patches are not available for risk mitigation

Technical Web Application Vulnerabilities Affecting End Users

Cause

- Technical (e.g. XSS, CSRF, etc.) or application logic vulnerabilities permit attackers to access or control content
- Although vulnerabilities reside on the server, victims can be end users due to trust relationships
  - User data stored on the server can be accessed/altered (web application attack – e.g. SQLi)
  - Attack can target end user data or actions via the web browser (naked browser attack)

Risk

- Vulnerabilities are regularly discovered on reputable sites
- End users may have no way of knowing that the have been the victim of an attack

Abuse of Functionality Affecting End Users

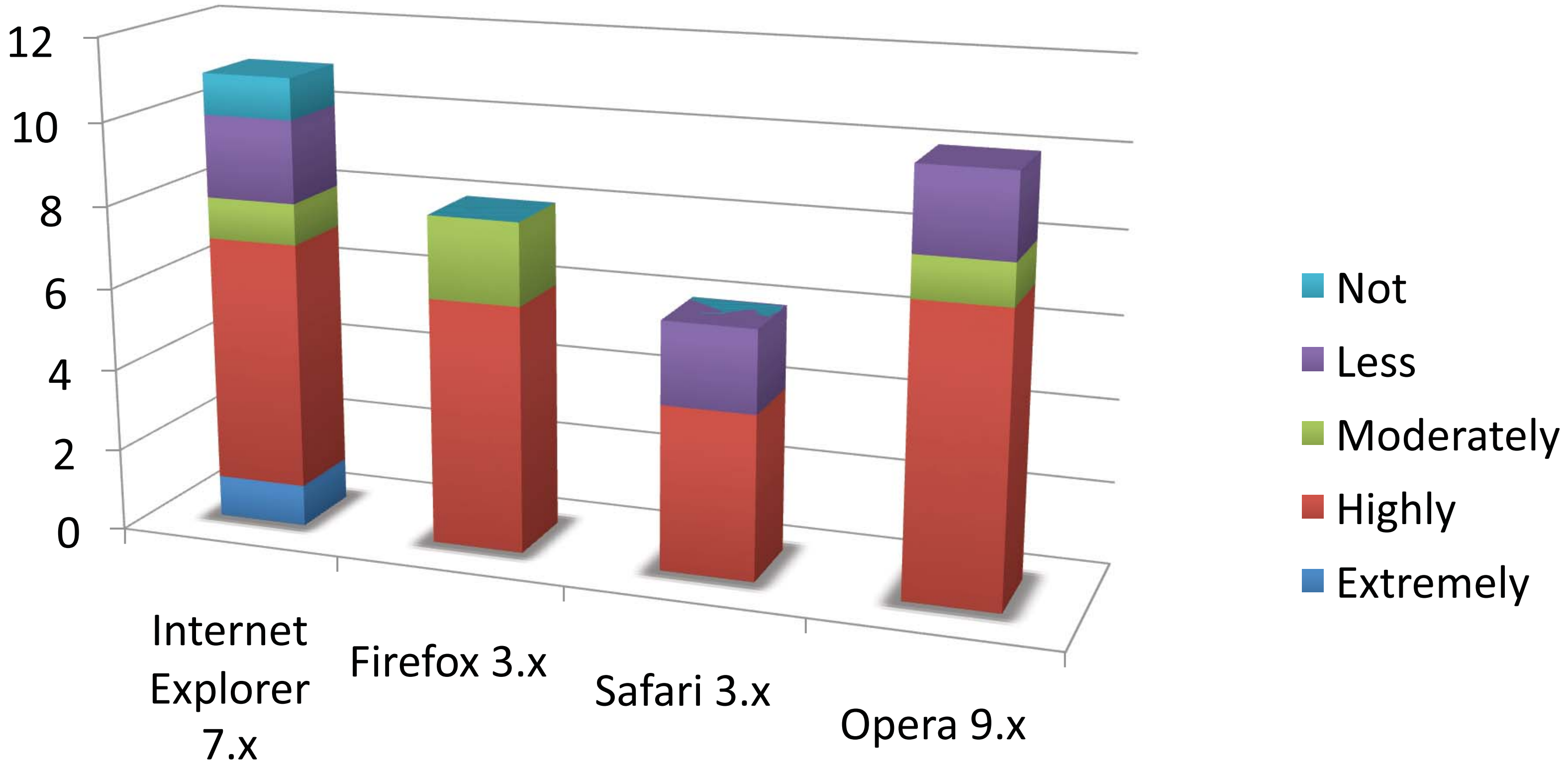
Cause

- No web application or browser vulnerability is abused
- Intended functionality is used in an unintended way
- Examples – clickjacking and URL redirection

Risk

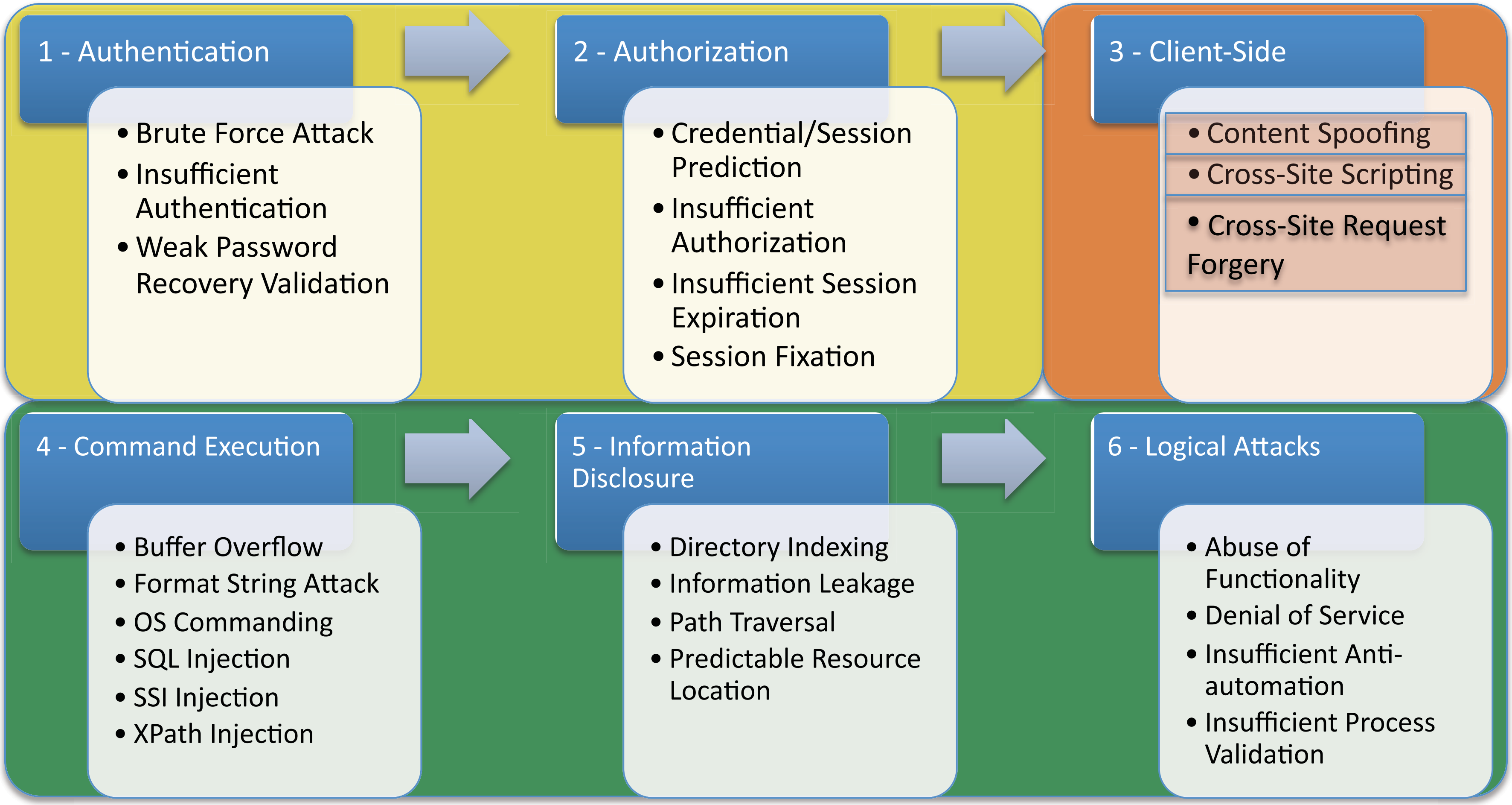
- Difficult to detect as traffic is legitimate
- Who takes responsibility for protection?

Web Browser Vulnerabilities



Statistics courtesy of Secunia, Inc.

WASC Threat Classification



1 - Authentication

- Brute Force Attack
- Insufficient Authentication
- Weak Password Recovery Validation

2 - Authorization

- Credential/Session Prediction
- Insufficient Authorization
- Insufficient Session Expiration
- Session Fixation

3 - Client-Side

- Content Spoofing
- Cross-Site Scripting
- Cross-Site Request Forgery

4 - Command Execution

- Buffer Overflow
- Format String Attack
- OS Commanding
- SQL Injection
- SSI Injection
- XPath Injection

5 - Information Disclosure

- Directory Indexing
- Information Leakage
- Path Traversal
- Predictable Resource Location

6 - Logical Attacks

- Abuse of Functionality
- Denial of Service
- Insufficient Anti-automation
- Insufficient Process Validation

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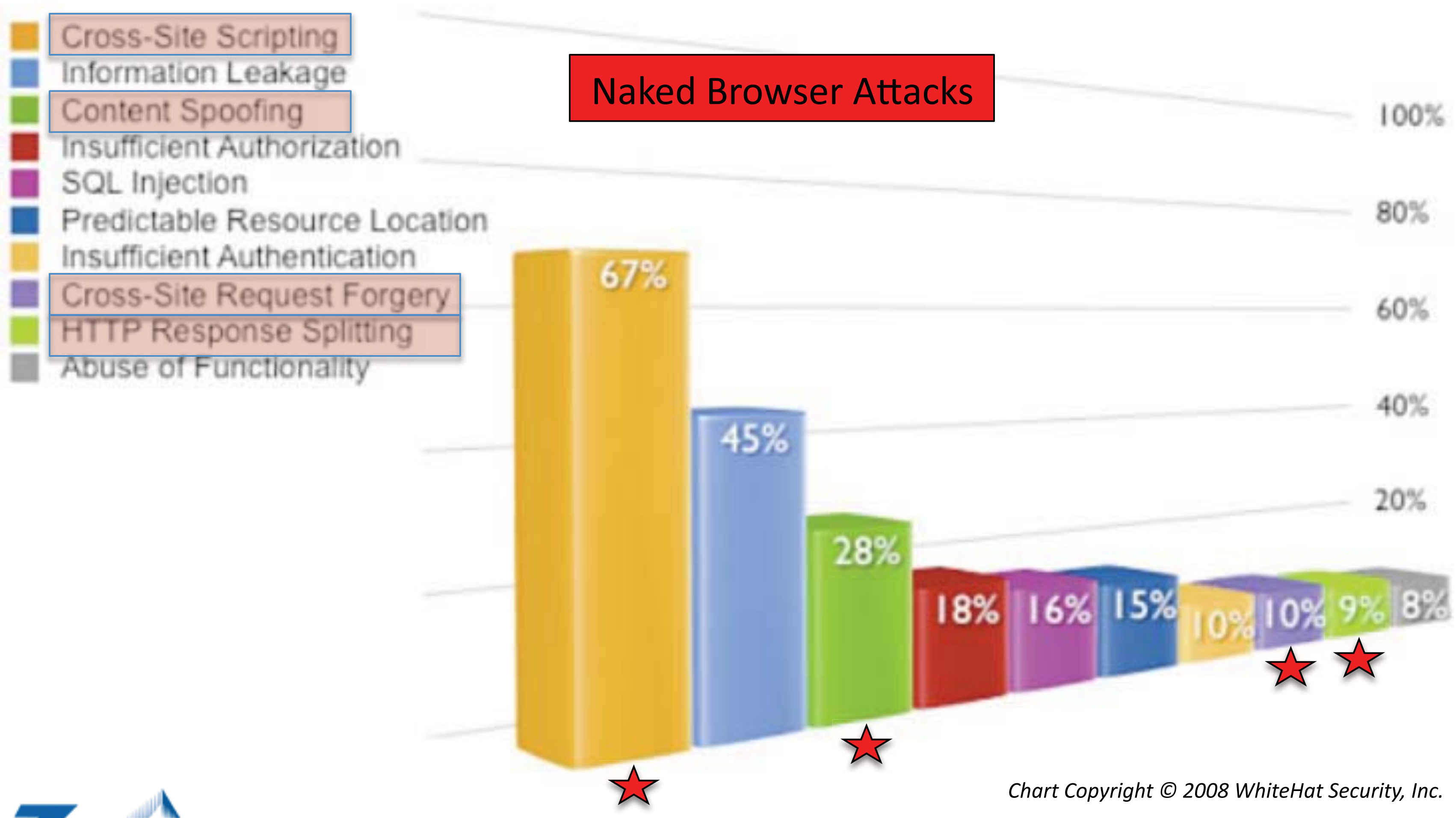
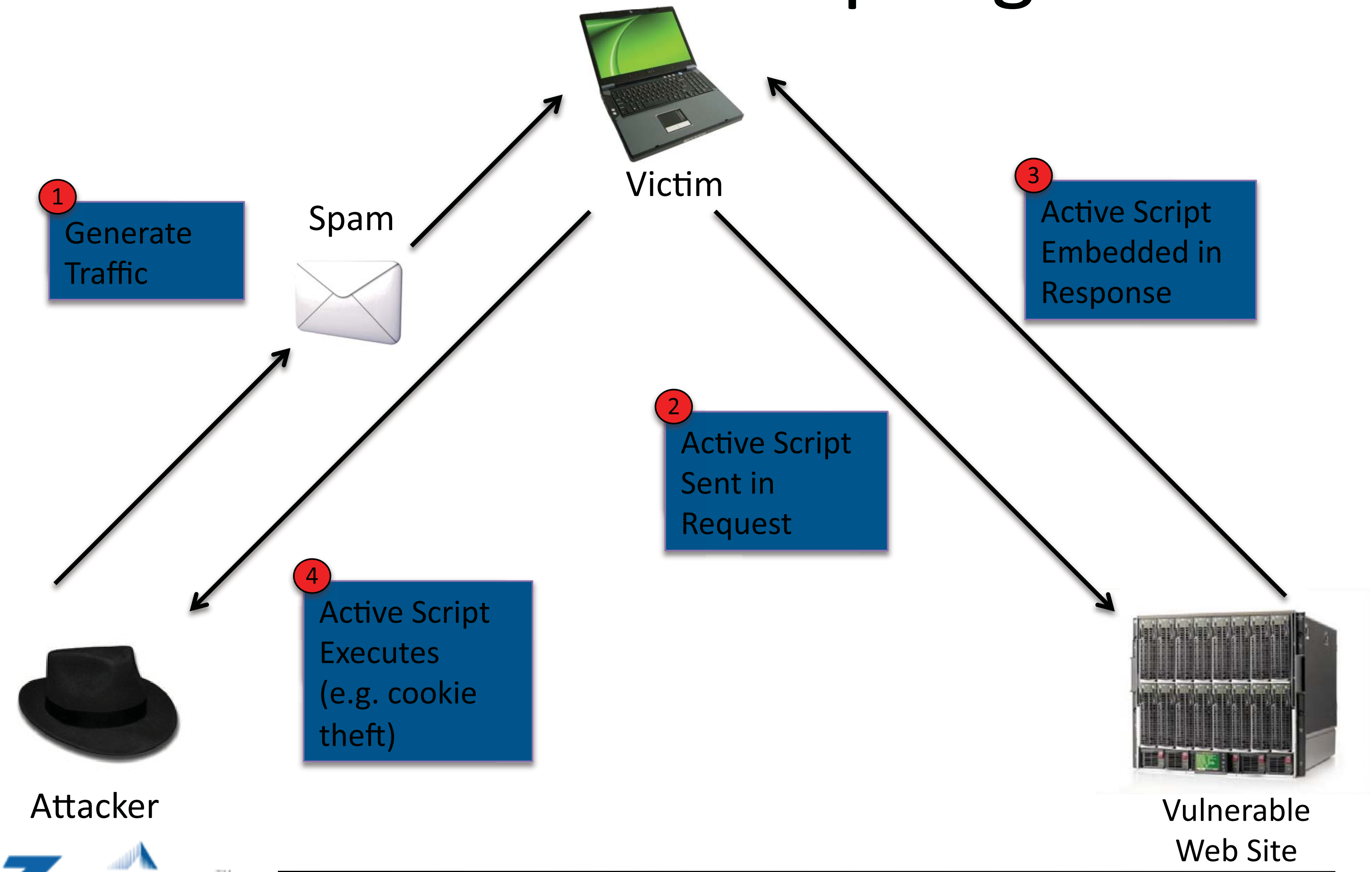
WhiteHat Security Statistics

December 2008



Naked Browser Attacks

Cross-Site Scripting



Victim

Spam

Attacker

Vulnerable Web Site

1 Generate Traffic

2 Active Script Sent in Request

3 Active Script Embedded in Response

4 Active Script Executes (e.g. cookie theft)

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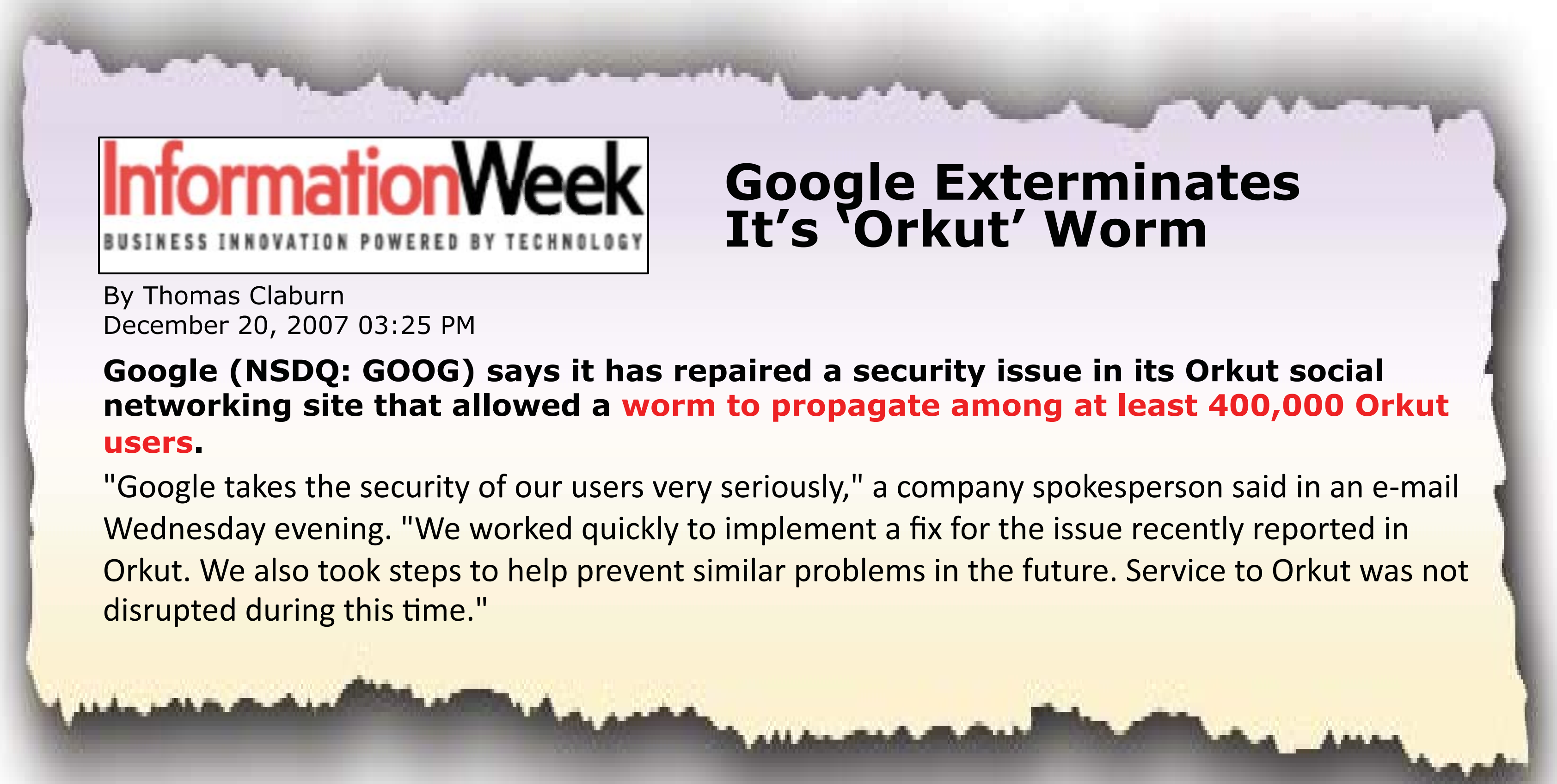
Orkut Worm



InformationWeek

BUSINESS INNOVATION POWERED BY TECHNOLOGY

Google Exterminates It’s ‘Orkut’ Worm

By Thomas Claburn
December 20, 2007 03:25 PM

Google (NSDQ: GOOG) says it has repaired a security issue in its Orkut social networking site that allowed a worm to propagate among at least 400,000 Orkut users.

"Google takes the security of our users very seriously," a company spokesperson said in an e-mail Wednesday evening. "We worked quickly to implement a fix for the issue recently reported in Orkut. We also took steps to help prevent similar problems in the future. Service to Orkut was not disrupted during this time."

Orkut Attack

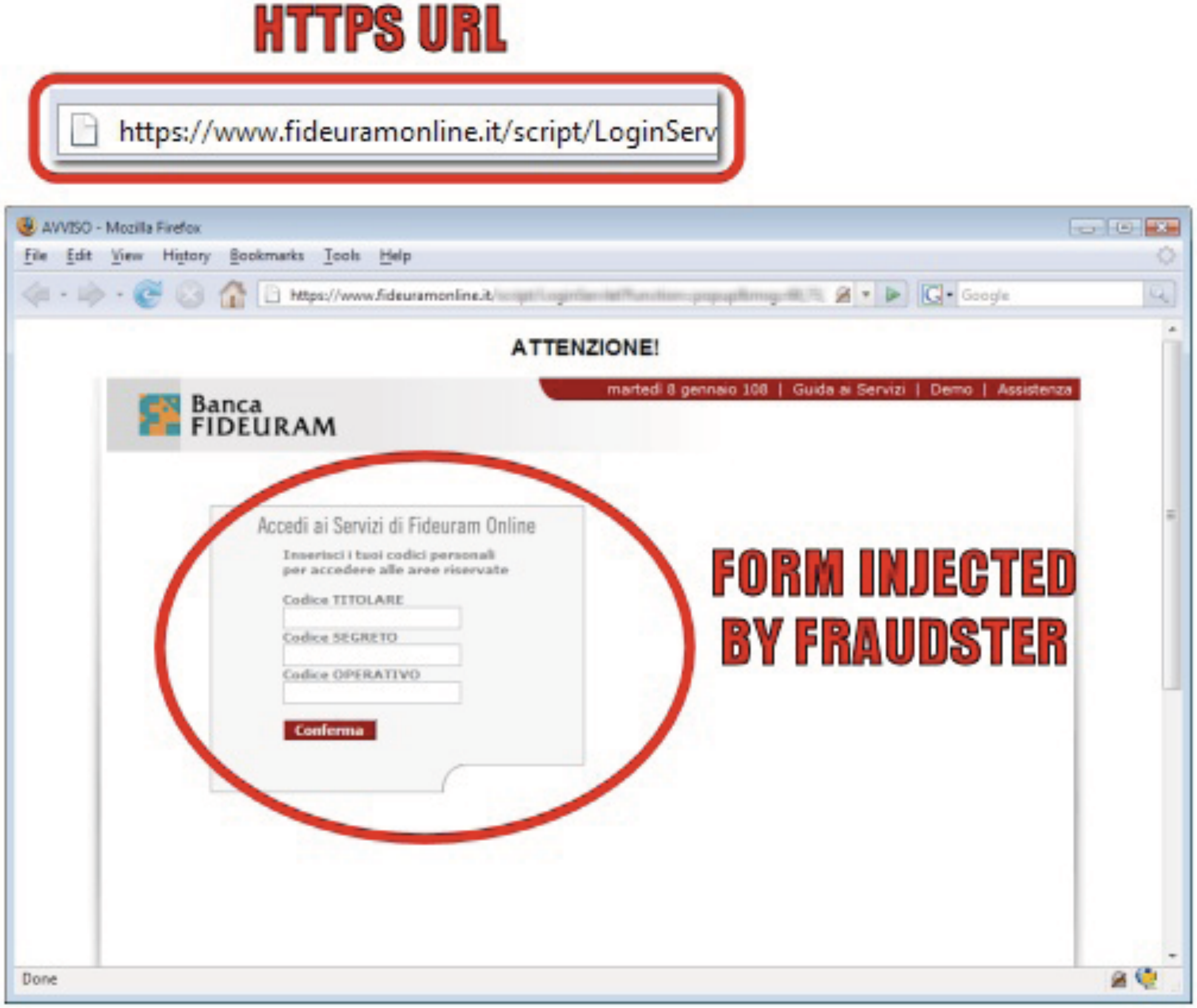
Process

- Email received from another Orkut user announcing a new scrapbook entry (message)
- Persistent XSS vulnerability allowed JavaScript to be embedded in scrapbook
- Simply viewing the entry caused addition to the "Infectados pelo Vírus do Orkut" (infected by the Orkut virus) group
- Scrapbook entry then sent to all friends and propagation continues

Risk

- Social networking sites allow and encourage user supplied content
- Weak input validation makes such attacks possible
- No user action required beyond viewing a page
- No malicious intent – attack conducted to highlight security vulnerability

Case Study: Banca Fideuram



HTTPS URL

https://www.fideuramonline.it/script/LoginServ

AVVISO - Mozilla Firefox

https://www.fideuramonline.it/

ATTENZIONE!

Banca FIDEURAM

martedì 8 gennaio 108 | Guida ai Servizi | Demo | Assistenza

Accedi ai Servizi di Fideuram Online

Inserisci i tuoi codici personali per accedere alle aree riservate

Codice TITOLARE

Codice SEGRETO

Codice OPERATIVO

Conferma

FORM INJECTED BY FRAUDSTER

Image Copyright © 2009 Netcraft Ltd.

Banca Fideuram Attack

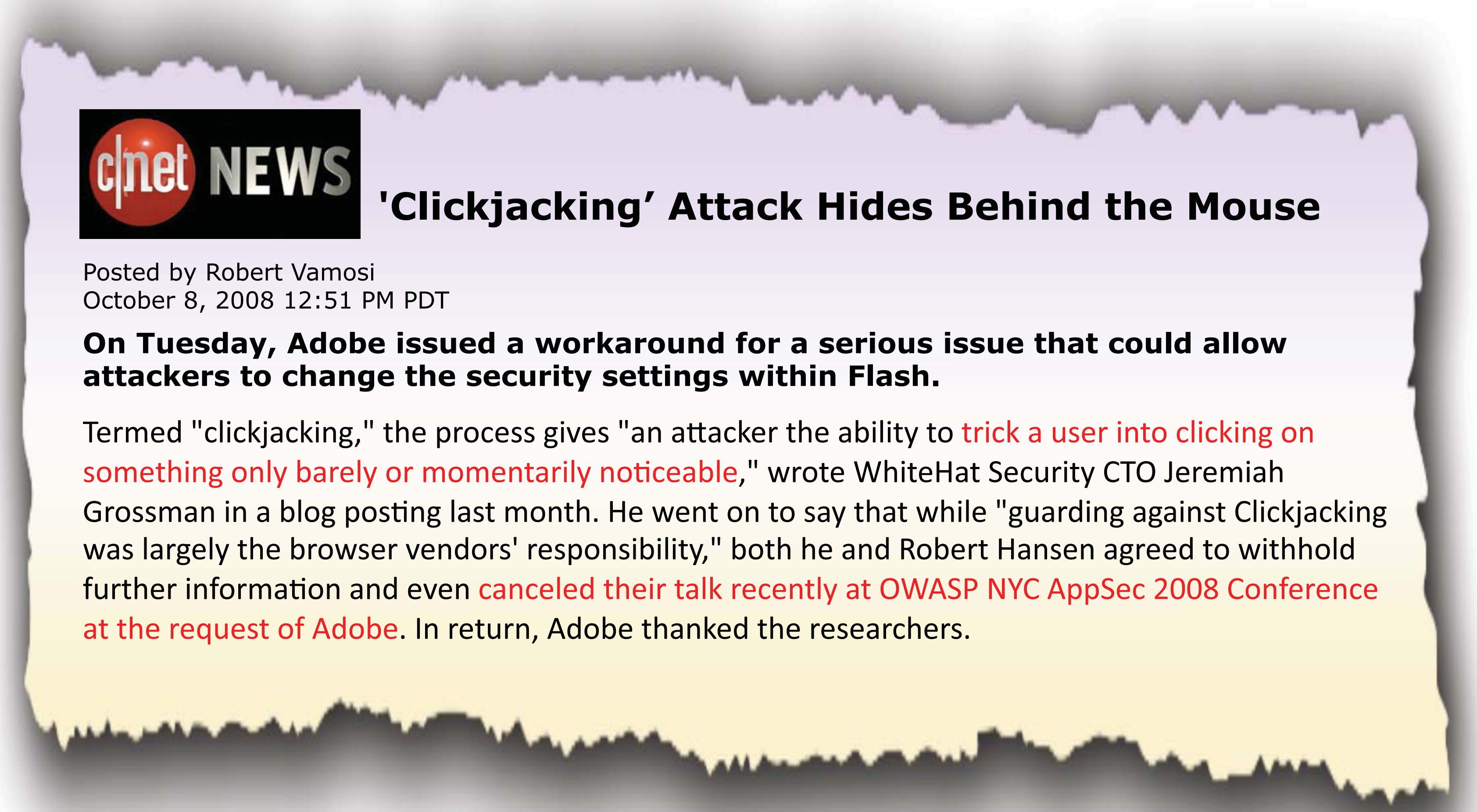
Process

- Social Engineering – Spam email used to generate traffic
- IFRAME injected into login page
- Injected code obfuscated - String.fromCharCode()
- Original login form obfuscated by attacker content
- Login credentials sent to attackers in Taiwan
- Login credentials redirected to original bank site

Risk

- XSS on SSL protected page
- Traditional browser security indicators useless
  - Address bar, SSL certificate, lock and key, HTTPS, etc.
- Victim's are unaware of attack due to successful login

Clickjacking



cnet NEWS

'Clickjacking' Attack Hides Behind the Mouse

Posted by Robert Vamosi
October 8, 2008 12:51 PM PDT

On Tuesday, Adobe issued a workaround for a serious issue that could allow attackers to change the security settings within Flash.

Termed "clickjacking," the process gives "an attacker the ability to trick a user into clicking on something only barely or momentarily noticeable," wrote WhiteHat Security CTO Jeremiah Grossman in a blog posting last month. He went on to say that while "guarding against Clickjacking was largely the browser vendors' responsibility," both he and Robert Hansen agreed to withhold further information and even canceled their talk recently at OWASP NYC AppSec 2008 Conference at the request of Adobe. In return, Adobe thanked the researchers.

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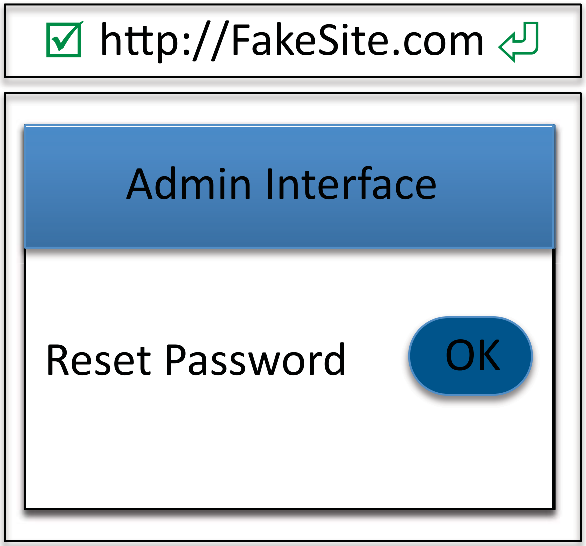
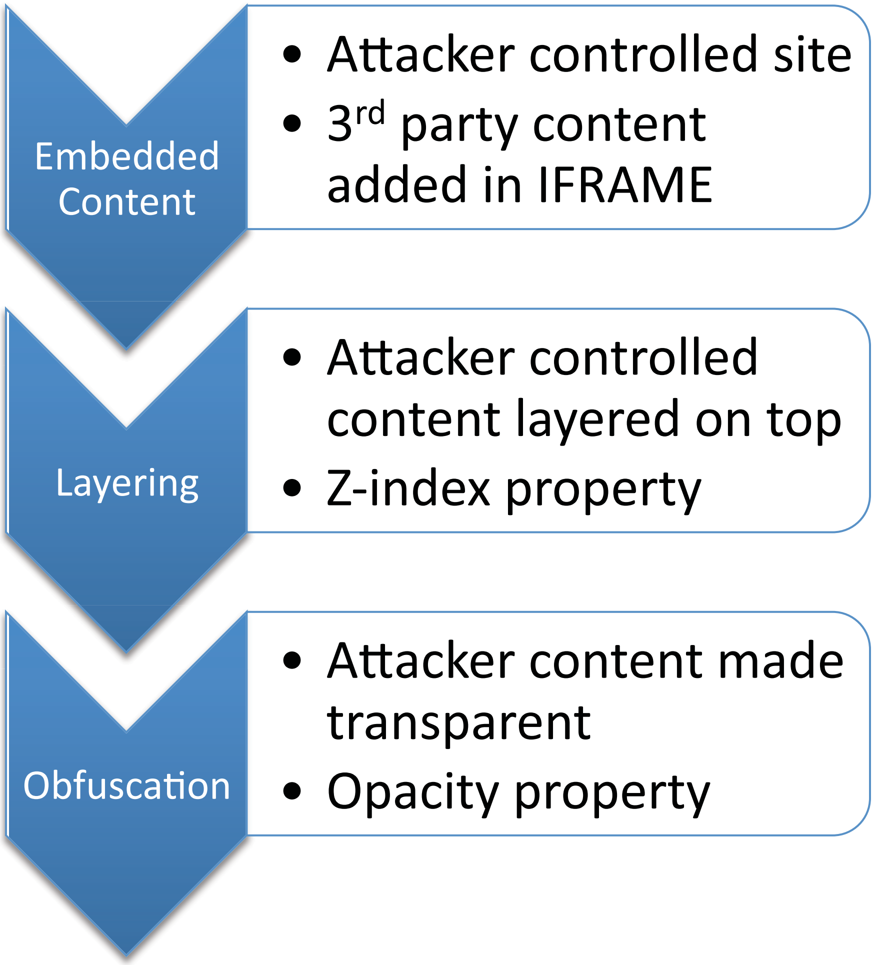
Clickjacking





Embedded Content

- Attacker controlled site
- 3rd party content added in IFRAME

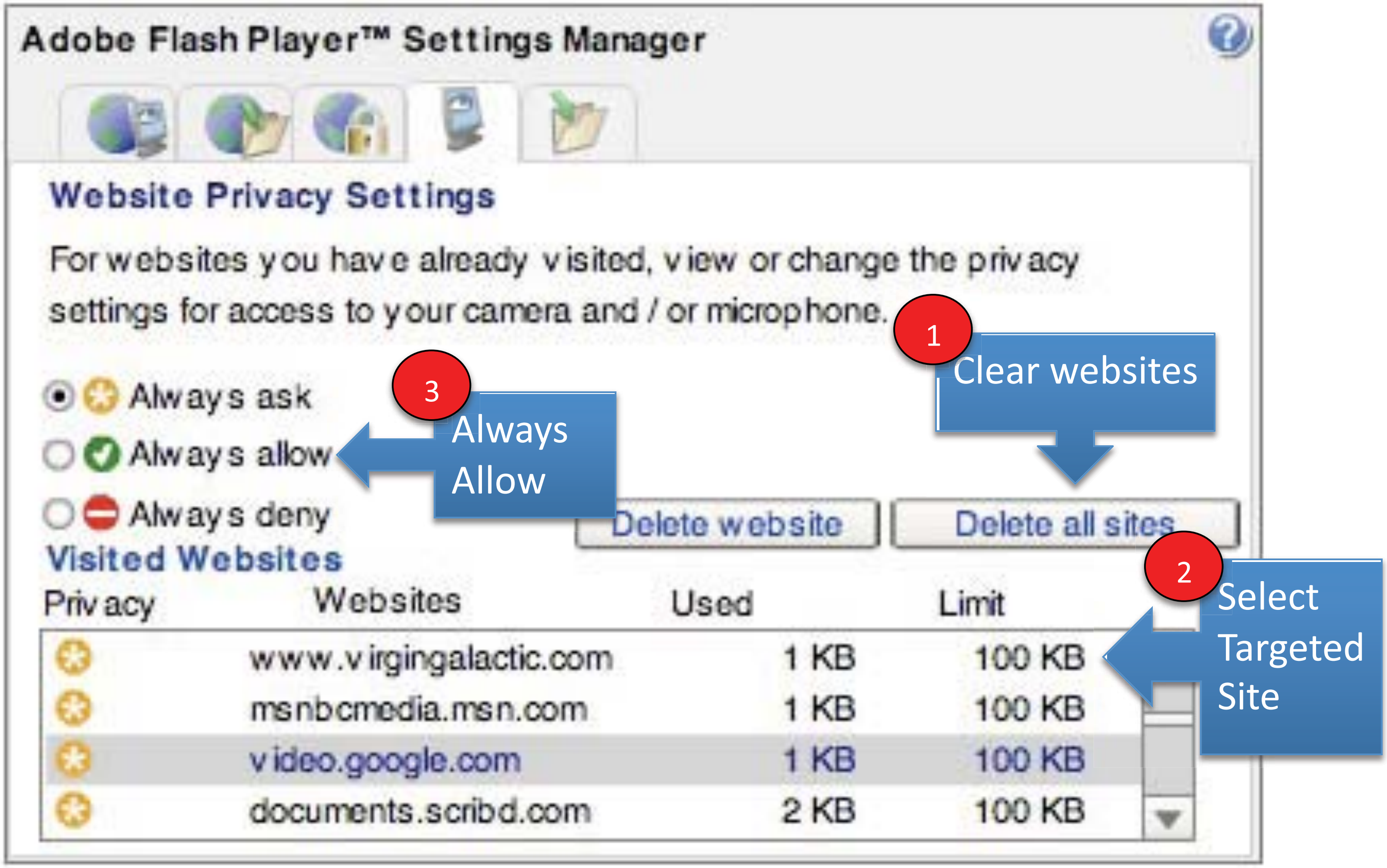
Layering

- Attacker controlled content layered on top
- Z-index property

Obfuscation

- Attacker content made transparent
- Opacity property

Adobe Flash



Adobe Flash Player™ Settings Manager

Website Privacy Settings

For websites you have already visited, view or change the privacy settings for access to your camera and / or microphone.

● Always ask

○ Always allow

○ Always deny

Delete website | Delete all sites

Visited Websites

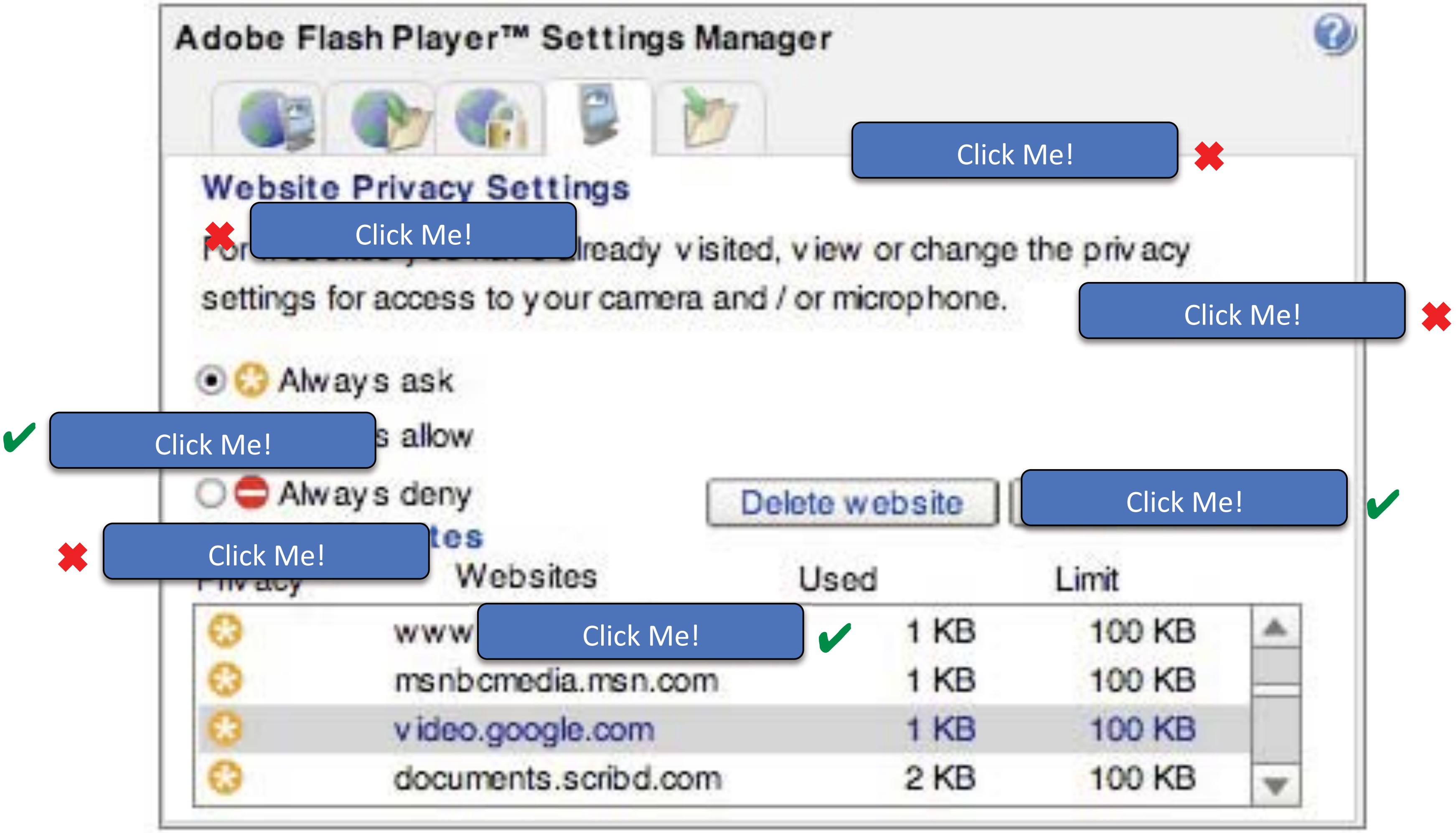
Privacy	Websites	Used	Limit
✱	www.virgingalactic.com	1 KB	100 KB
✱	msnbcmedia.msn.com	1 KB	100 KB
✱	video.google.com	1 KB	100 KB
✱	documents.scribd.com	2 KB	100 KB

1 Clear websites

2 Select Targeted Site

3 Always Allow

Adobe Flash



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○ Always deny

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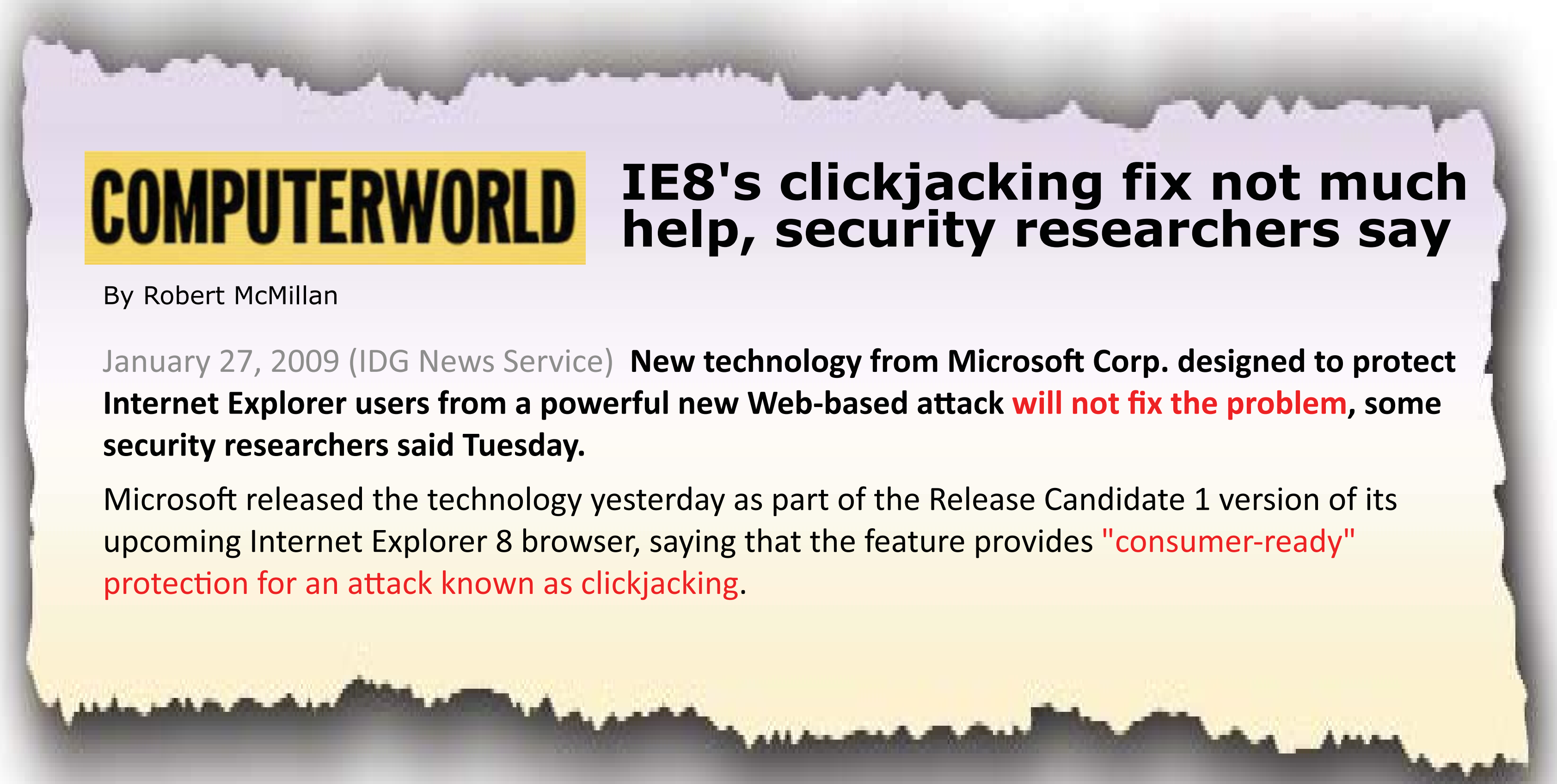
Privacy	Websites	Used	Limit
●	www	1 KB	100 KB
●	msnbcmedia.msn.com	1 KB	100 KB
●	video.google.com	1 KB	100 KB
●	documents.scribd.com	2 KB	100 KB

IE8 Clickjacking Controls



COMPUTERWORLD

IE8's clickjacking fix not much help, security researchers say

By Robert McMillan

January 27, 2009 (IDG News Service) **New technology from Microsoft Corp. designed to protect Internet Explorer users from a powerful new Web-based attack will not fix the problem, some security researchers said Tuesday.**

Microsoft released the technology yesterday as part of the Release Candidate 1 version of its upcoming Internet Explorer 8 browser, saying that the feature provides "consumer-ready" protection for an attack known as clickjacking.

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BSoD – NIN Concert

Windows

A fatal exception 0E has occurred at 0028:C0011E36 in VXD VMM(01) + 00010E36. The current application will be terminated.

- Press any key to terminate the current application.
- Press CTRL+ALT+DEL again to restart your computer. You will lose any unsaved information in all applications.

Press any key to continue

Other Naked Attacks

Cross-Site Request Forgery (CSRF)

- Browser/server trust is abused by social engineering victim to perform an unintended action (e.g. password rest, post content, etc.)

HTTP Response Splitting

- Ability to inject CRLF characters into the headers of a response, thereby generating two responses to a single request – one fully attacker controlled
- Can be used to poison web caches with attacker controlled content

Content Spoofing

- Ability to override the content of a web page
- Valuable for phishing attacks
- Can leverage browser vulnerabilities or weaknesses in web application logic

DNS Cache Poisoning

- LAN or Internet based attacks (aka Dan Kaminsky attack)
- Allows for traffic redirection to attacker controlled sites

URL Redirection

- Sites use redirection techniques to track users leaving the site
- Example: http://original_site.com/redirect?x=http://new_site.com
- Can be abused by phishers attempting to hide destination site

Challenges

Legitimate Traffic

- Identifying attacks can be like looking for hay in a haystack

Unique Attacks

- Small changes in content/encoding render signatures useless

Targeted attacks

- Difficult to anticipate/identify

Defending Against Attack

Server vs. Client

- Virtually all solutions/papers focus on securing web applications, not browsers
- This protects the DMZ, but not the desktop

Protecting Servers is Easy

- Hundreds of desktops for every server
- Server content has change control
- Administrators have security knowledge

Existing Solutions

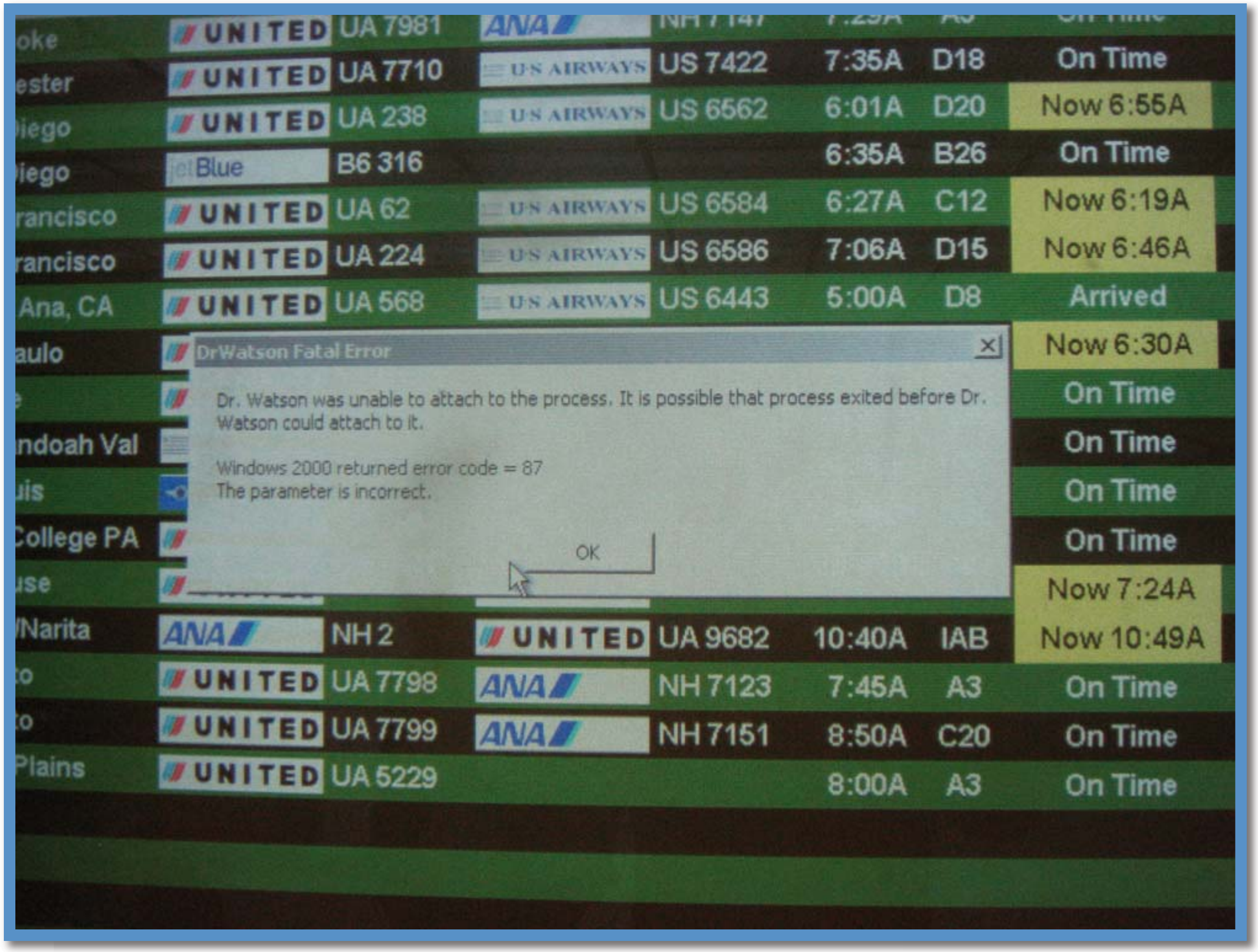
Host Based

- NoScript
  - Firefox extension
  - XSS and clickjacking detection
- Internet Explorer 8
  - XSS detection
  - Clickjacking protection – requires web app. component

Network Based

- Some IDS/IPS signatures for specific attacks (e.g. XSS vuln. on XYZ blogging application)

Boarding Dr. Watson



DrWatson Fatal Error

Dr. Watson was unable to attach to the process. It is possible that process exited before Dr. Watson could attach to it.

Windows 2000 returned error code = 87
The parameter is incorrect.

oke	UNITED	UA 7981	ANA	NH 7147	7:25A	A3	On Time
ester	UNITED	UA 7710	US AIRWAYS	US 7422	7:35A	D18	On Time
iego	UNITED	UA 238	US AIRWAYS	US 6562	6:01A	D20	Now 6:55A
iego	jetBlue	B6 316			6:35A	B26	On Time
rancisco	UNITED	UA 62	US AIRWAYS	US 6584	6:27A	C12	Now 6:19A
rancisco	UNITED	UA 224	US AIRWAYS	US 6586	7:06A	D15	Now 6:46A
Ana, CA	UNITED	UA 568	US AIRWAYS	US 6443	5:00A	D8	Arrived
aulo							Now 6:30A
e							On Time
ndoah Val							On Time
uis							On Time
College PA							On Time
use							Now 7:24A
Narita	ANA	NH 2	UNITED	UA 9682	10:40A	IAB	Now 10:49A
o	UNITED	UA 7798	ANA	NH 7123	7:45A	A3	On Time
o	UNITED	UA 7799	ANA	NH 7151	8:50A	C20	On Time
Plains	UNITED	UA 5229			8:00A	A3	On Time

Defense In Depth

Monitor

- Identify anomalous traffic patterns

Manage

- Control what users can do on the web, not just where they can go

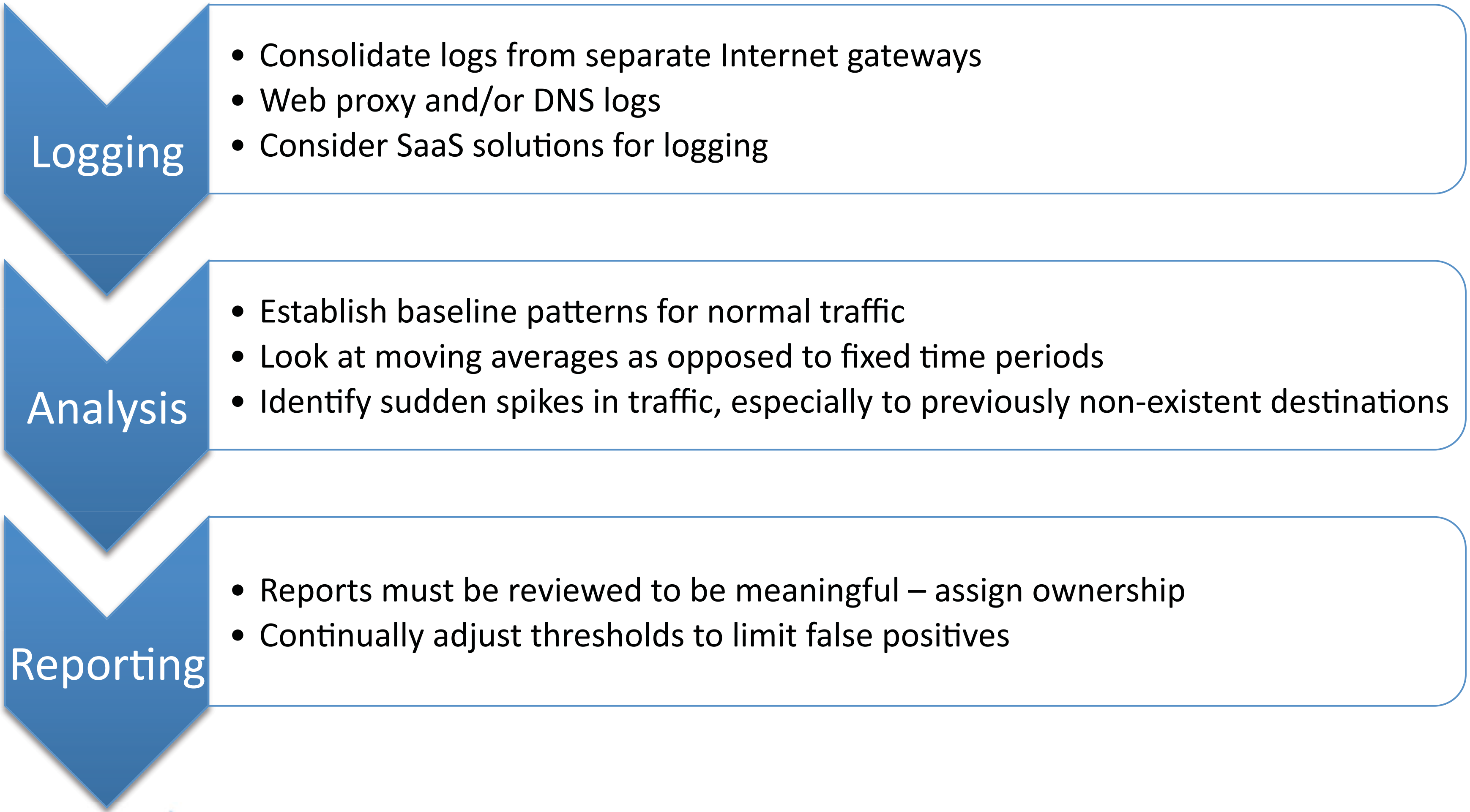
Merge

- Incorporate third party data feeds

Educate

- Empower users to proactively identify risks

Monitor



Logging

- Consolidate logs from separate Internet gateways
- Web proxy and/or DNS logs
- Consider SaaS solutions for logging

Analysis

- Establish baseline patterns for normal traffic
- Look at moving averages as opposed to fixed time periods
- Identify sudden spikes in traffic, especially to previously non-existent destinations

Reporting

- Reports must be reviewed to be meaningful – assign ownership
- Continually adjust thresholds to limit false positives

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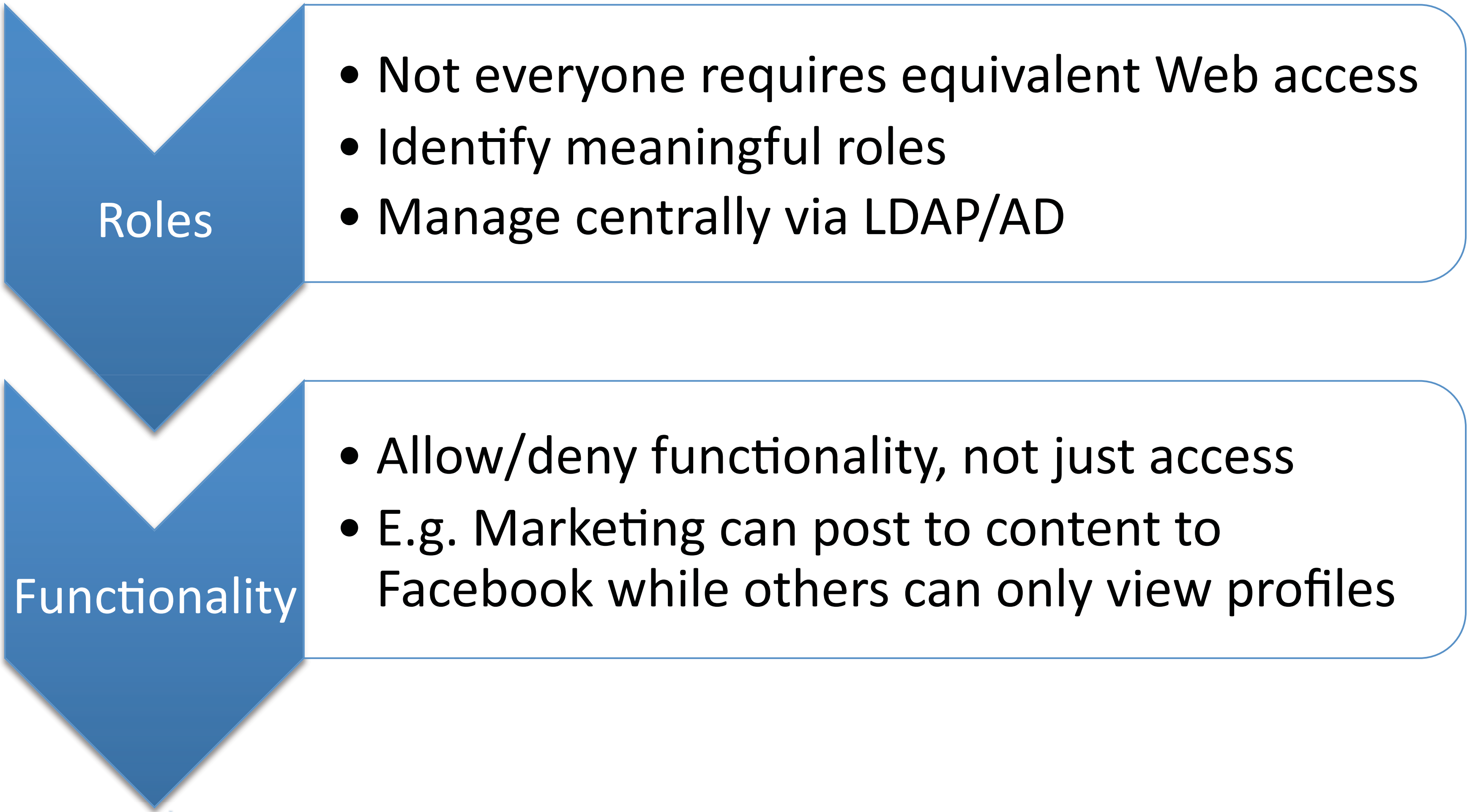
Manage



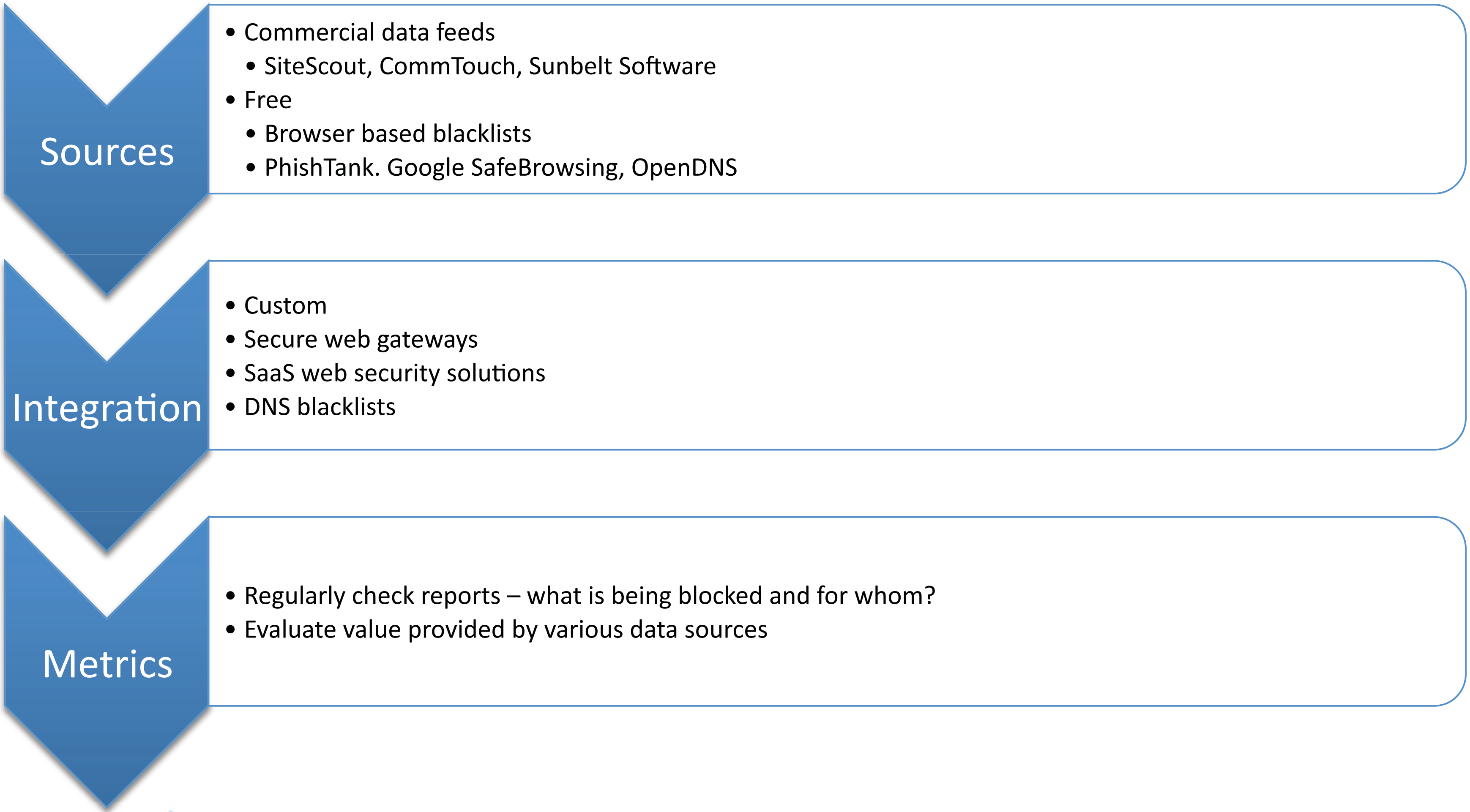
Roles

- Not everyone requires equivalent Web access
- Identify meaningful roles
- Manage centrally via LDAP/AD

Functionality

- Allow/deny functionality, not just access
- E.g. Marketing can post to content to Facebook while others can only view profiles

Merge



Sources

- Commercial data feeds
  - SiteScout, CommTouch, Sunbelt Software
- Free
  - Browser based blacklists
  - PhishTank. Google SafeBrowsing, OpenDNS

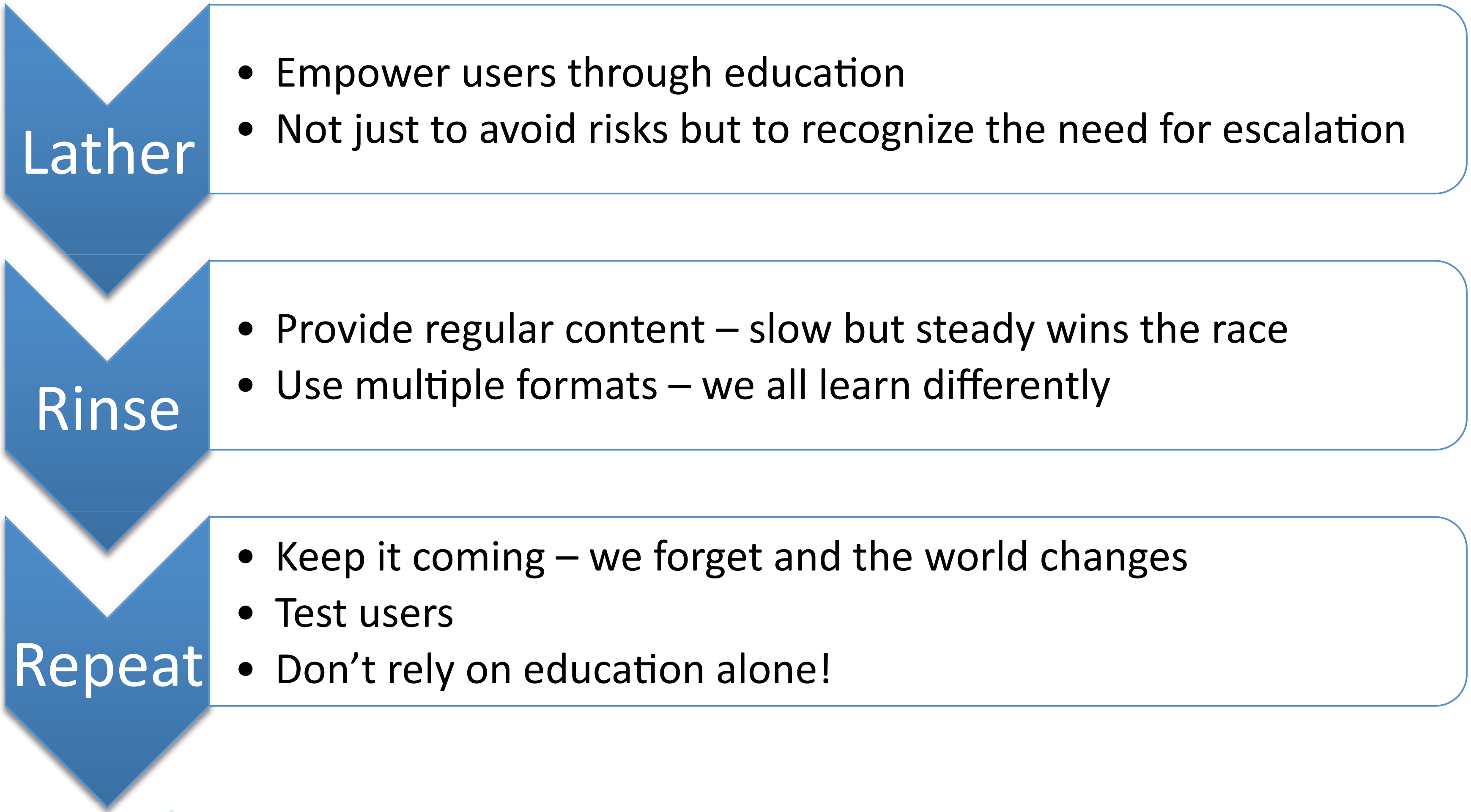
Integration

- Custom
- Secure web gateways
- SaaS web security solutions
- DNS blacklists

Metrics

- Regularly check reports – what is being blocked and for whom?
- Evaluate value provided by various data sources

Educate



Lather

- Empower users through education
- Not just to avoid risks but to recognize the need for escalation

Rinse

- Provide regular content – slow but steady wins the race
- Use multiple formats – we all learn differently

Repeat

- Keep it coming – we forget and the world changes
- Test users
- Don’t rely on education alone!

Future

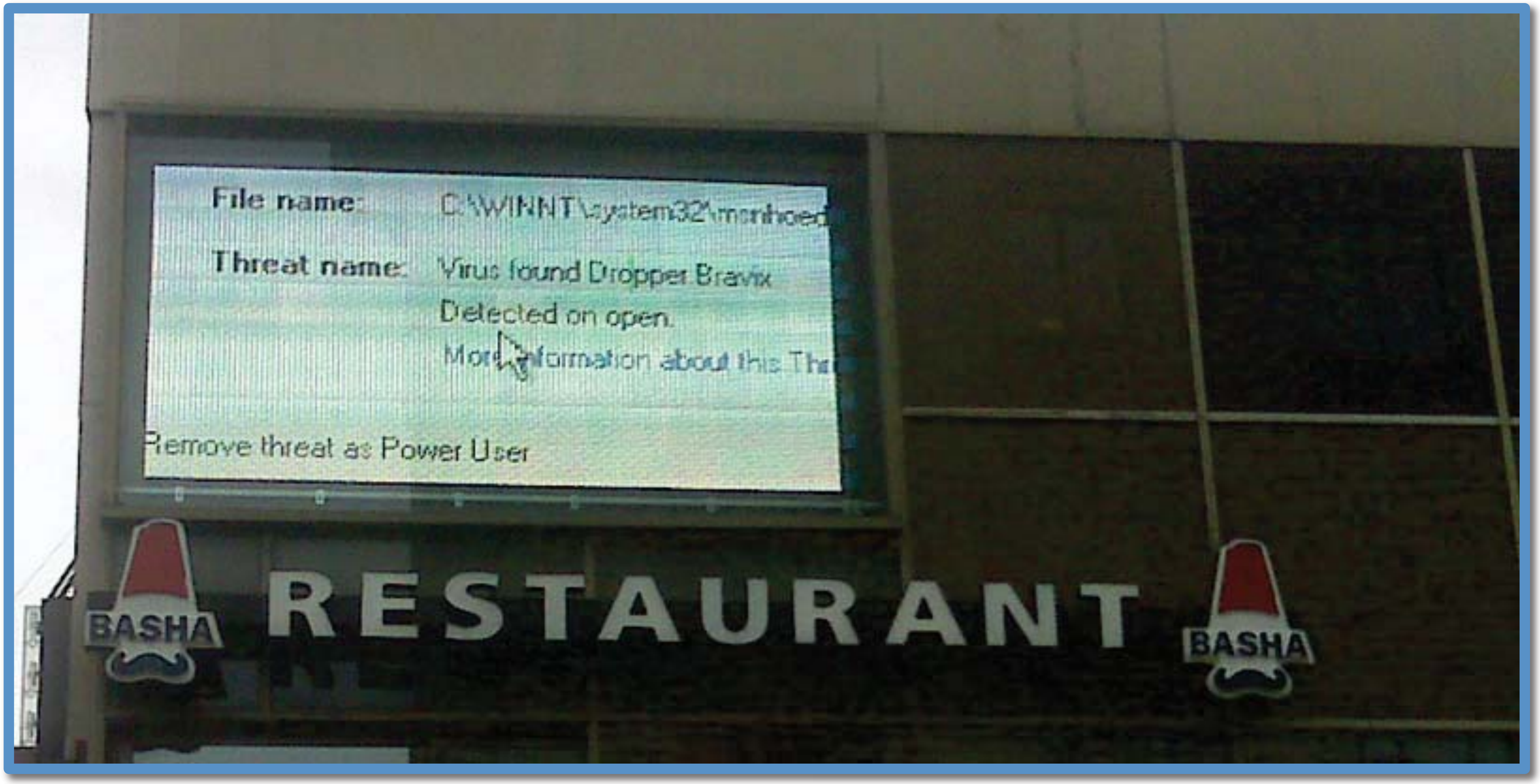
Vendors

- Need to take responsibility for naked attacks
- Applications need to be proactively secure
  - Not just blacklists (e.g. phishing/malicious URLs)
- Application developers (e.g. IE) need to look to look to development platforms (e.g. .Net) for inspiration

Attackers

- Increased use of targeted attacks
- Malicious web based worms
- Abuse of web APIs

Restaurant Virus?



File name: C:\WINNT\system32\msnhoed

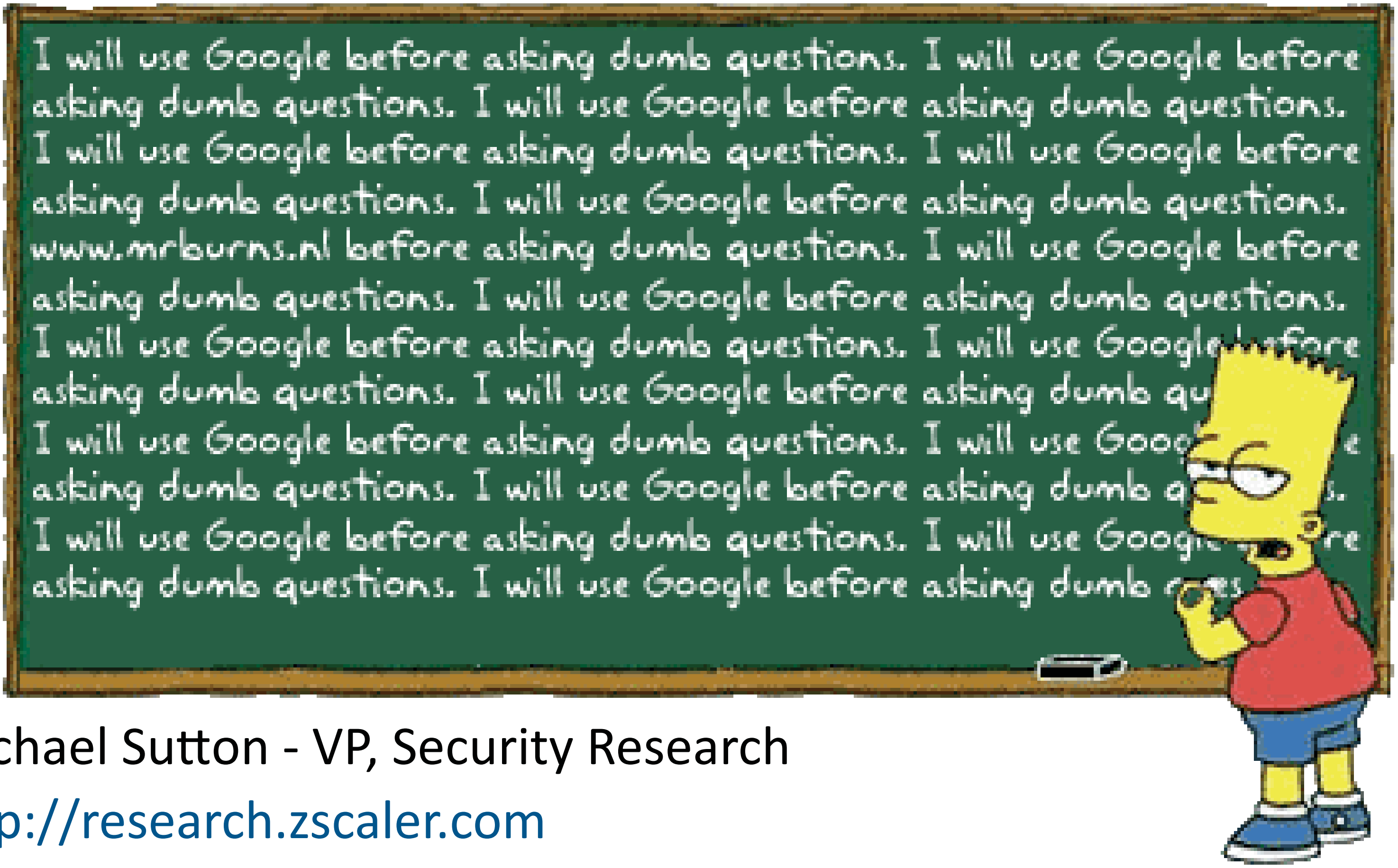
Threat name: Virus found Dropper Bravix

Detected on open.

More information about this Thr

Remove threat as Power User

Questions?


I will use Google before asking dumb questions. I will use Google before
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