# Web Application Firewalls: Detection, Bypassing and Exploitation

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The OWASP Foundation
http://www.owasp.org

# $ whois WendelGH

- PT Consultant at Trustwave's SpiderLabs
- Over 7 years in the security industry
- Vulnerability discovery Webmails, AP, Citrix, etc
- Spoke in YSTS 2.0, Defcon 16, H2HC and others
- Affiliated to Hackaholic team

# $ whois SandroGauci

- Founder and CSO EnableSecurity
- From .mt
- Security software
  - VOIPPACK (CANVAS addon)
  - Surfjack - insecure cookies
  - SIPVicious
- Security research papers
- Been around for > 9 years

# Introduction

- WAF - Web Application Firewall
- next generation protection
- what can we do?
  - can be identified, detected
  - bypassing the rules
  - exploit WAFs

# What is WAF?

- Attack signatures or abnormal behavior based
- WAFs products: software or hardware appliance.
- Flavors:
  - a reverse proxy
  - embedded
  - connected in a switch (SPAN or RAP)
- WAF products detect both inbound
- Some also detect outbound attacks

# Who uses WAFs?

- Many banks around the world
- Companies which need high protection
- Many companies in compliance with PCI DSS (Payment Card Industry - Data Security Standard)

# Operation Modes

- Negative model (blacklist based)
- Positive model (whitelist based)
- Mixed / Hybrid

# The negative model

- Relies on a database of known attacks
- Eg. XSS strings like <script>, </script>, String.fromCharCode, etc.
- Often regular expressions

# Whitelist model

- Whitelist based
- Learning mode to create a security policy of known “good” HTTP traffic
  - Known as dynamic profiling technology by some
- Example:
  Page news.jsp, the field "id" only accept numbers [0-9] and starting at 0 until 65535
  - news.jsp?id=-1 would not be allowed

## Common Weaknesses

- Design issues
  - WAFs have to be similar to the web apps and http servers that they need to protect
  - Blacklists are by design “flawed”
- Bad implementation
  - Parsing issues
- Again - a WAF needs to do a lot of things that the web app and http server does
  - ergo they can have similar security flaws!

# Detection

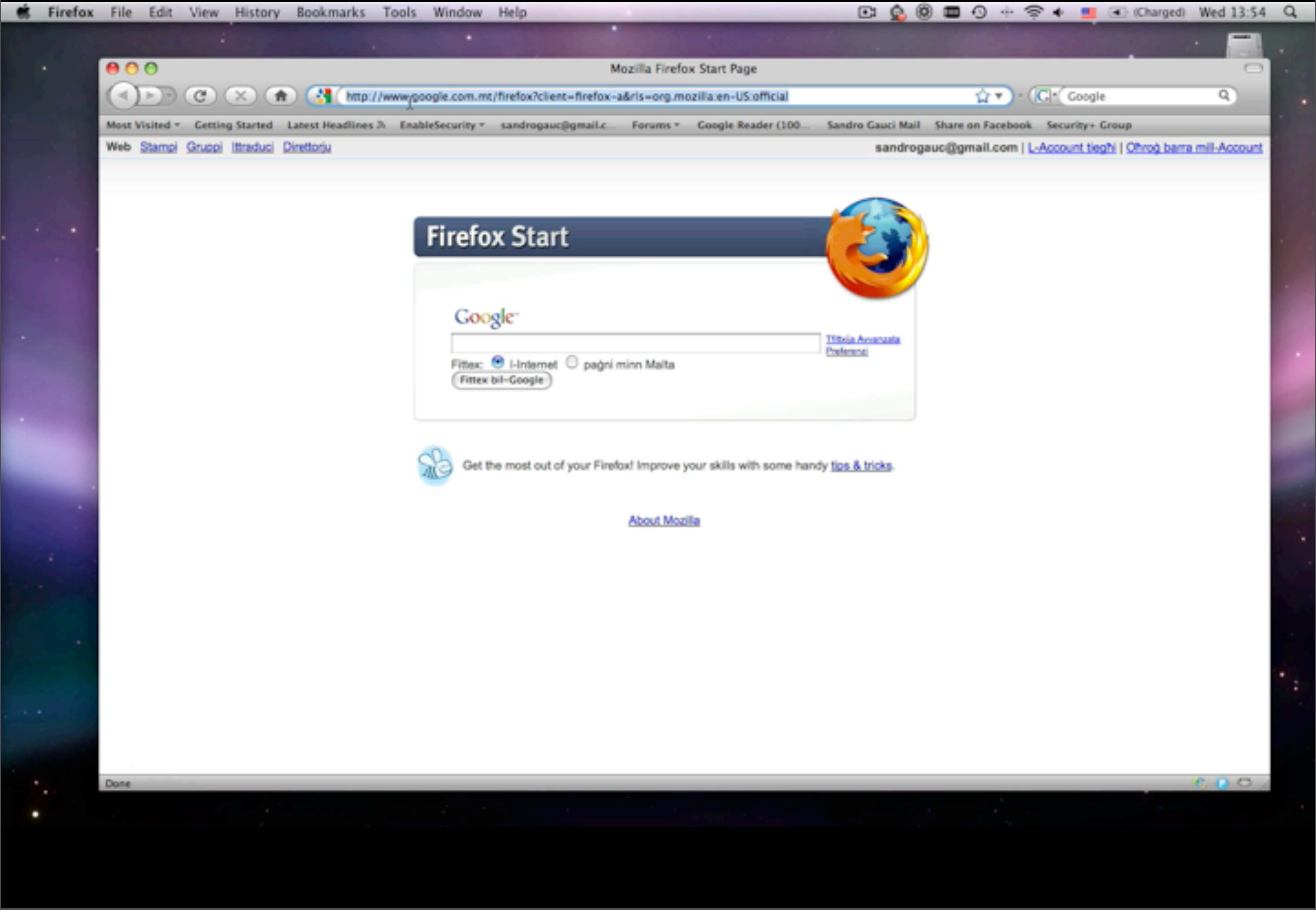
- A number of products can be detected
  - sometimes by design
- Detection is not a big deal but
  - ... sometimes we're told that WAFs are 'invisible'
  - the better you know your enemy (or client), the better
  - helps in a penetration test or targeted attack
  - shows that stealth attacks are possible

# Detection

- Cookies
  - Reason: some WAFs are also load balancers
- Headers
  - Header rewriting
  - Most obvious would be "Server"
  - Sometimes is a feature called “server cloaking”
  - “Connection” header might be changed to Cneonction or nnCoection
- Response codes
  - 404 error codes for existent scripts
  - and 403 for non existent ones

# Detection via response codes

- 404 error codes for existent scripts
- Different error codes (404, 400, 401, 403, 501, etc) for hostile parameters (even non existent ones) in valid pages.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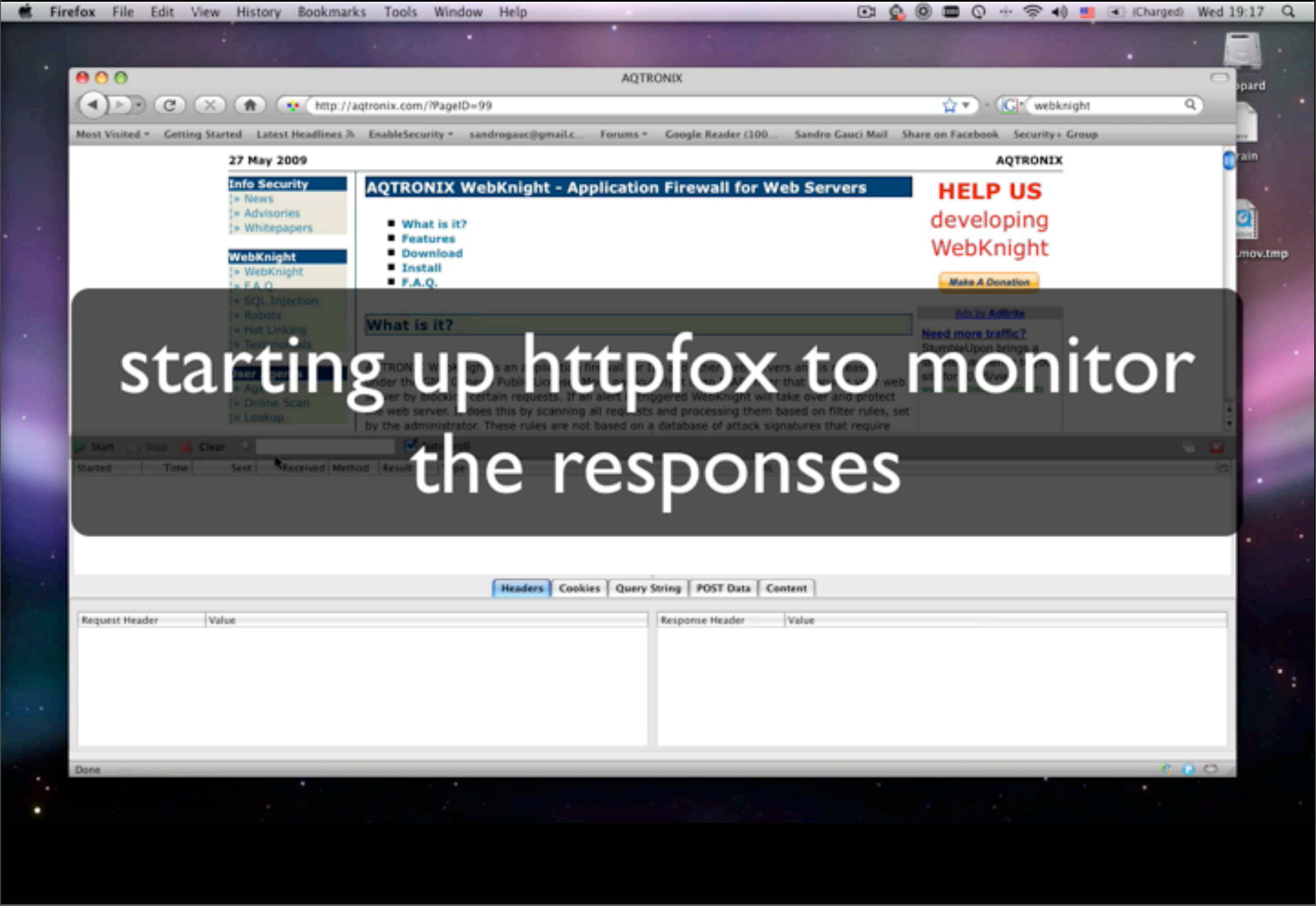
Get the most out of your Firefox! Improve your skills with some handy tips & tricks.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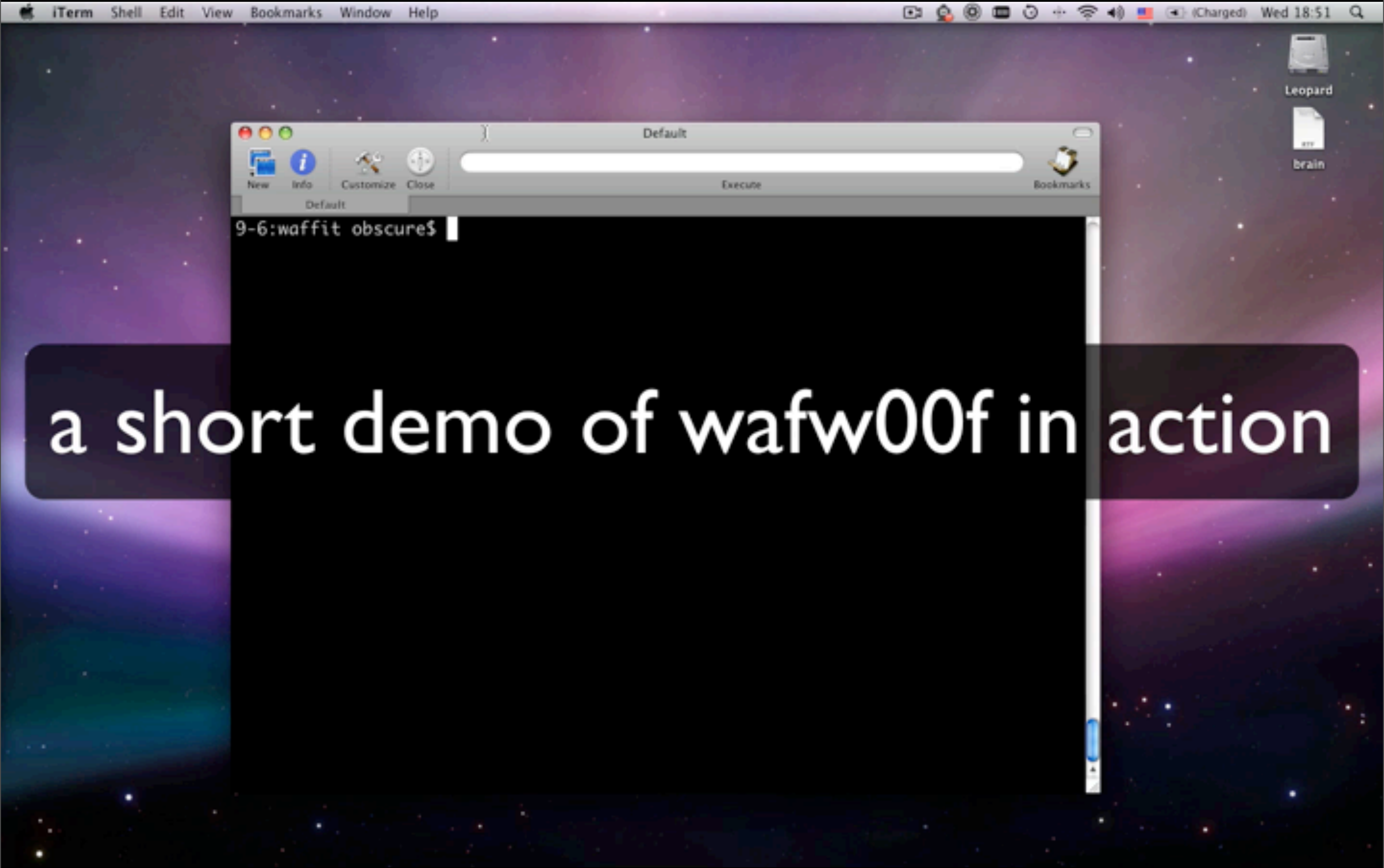
27 May 2009
AQTRONIX
Info Security
News
Advisories
Whitepapers
WebKnight
WebKnight
F.A.Q.
SQL Injection
Robots
Hot Linking
Testimonials
Online Scan
Lookup
AQTRONIX WebKnight - Application Firewall for Web Servers
What is it?
Features
Download
Install
F.A.Q.
HELP US developing WebKnight
Make A Donation
Ads by AdBrite
Need more traffic?
What is it?
Start Stop Clear
Started Time Sent Received Method Result Type
Headers Cookies Query String POST Data Content
Request Header Value
Response Header Value
Done

starting up httpfox to monitor the responses

# Automating WAF detection

- WAFW00F
  - Detect 20 different WAF products
    - the number keeps changing thanks to contributions :-)
  - Options to detect multiple WAFs in place
  - Generic detection methods included!
- Get your copy
  - waffit.googlecode.com
  - Please contribute



```
9-6:waffit obscure$ 
```

# a short demo of wafw00f in action

# Bypassing a WAF

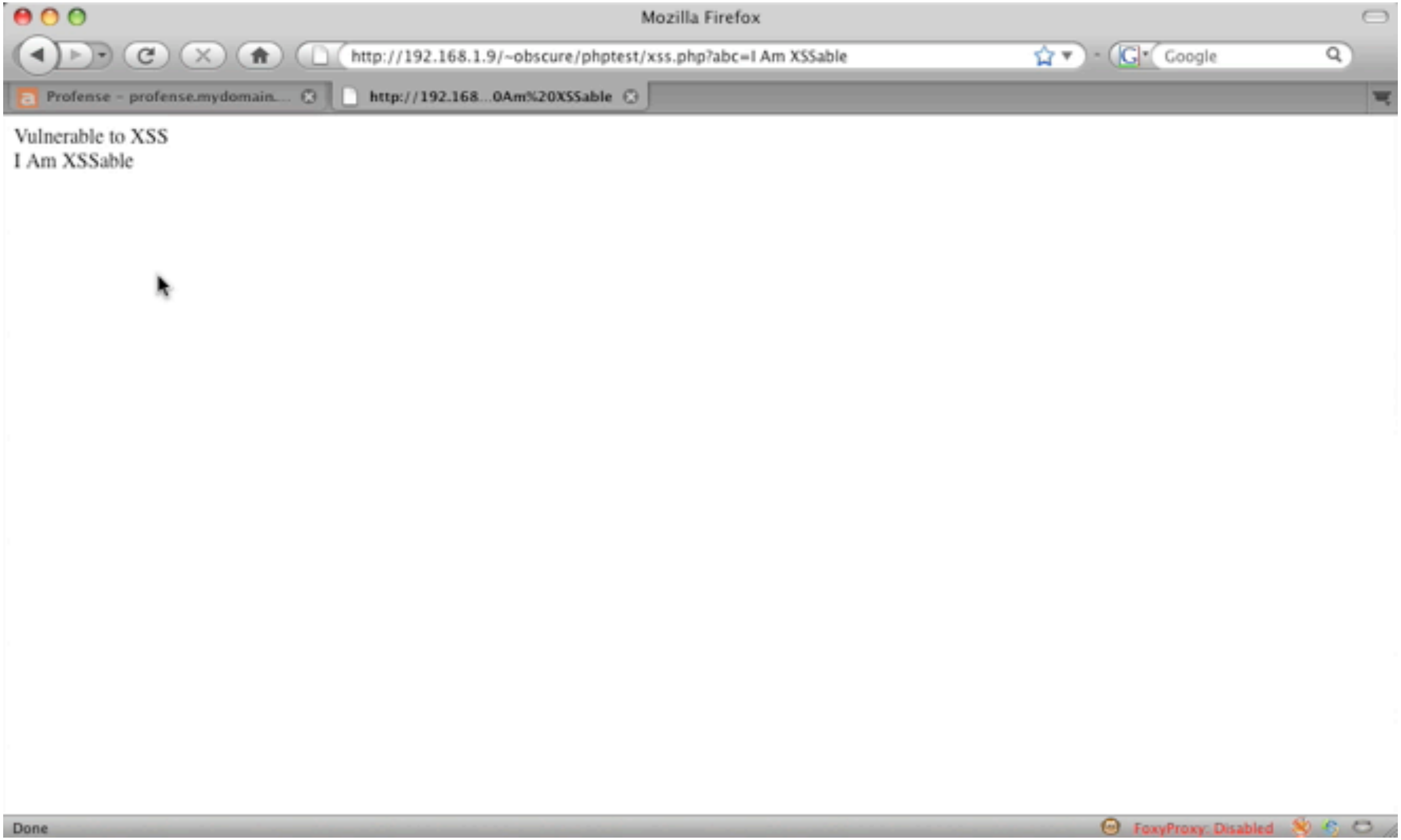
- Fingerprint the rules
- Detect allowed / denied strings
- Combinations of allowed or denied strings
- Modify your attack to not match the blacklist

# More on bypassing WAFs

- Encoding and language support, character sets
- Spaces, comments, case sensitive mutation, Unicode (%uc0af and %c0%af), etc
- The web server may parse, decode and interpret and HTTP request differently from the WAF
- HTML and JS is very flexible
- Various methods to split and encode your strings

# Bypassing rules

- "Our Favorite XSS Filters and how to Attack Them" by Eduardo Vela & David Lindsay
  - Bypass the rules by splitting the attack (eval('al'%2b'lert(0)')
- "Shocking News in PHP Exploitation" by Stefan Esser
  - Using "malformed" multipart/form-data to bypass most Modsecurity rules
  - F5 BIG-IP ASM could be bypassed by sending it multipart/form-data that was interpreted differently by PHP than ASM

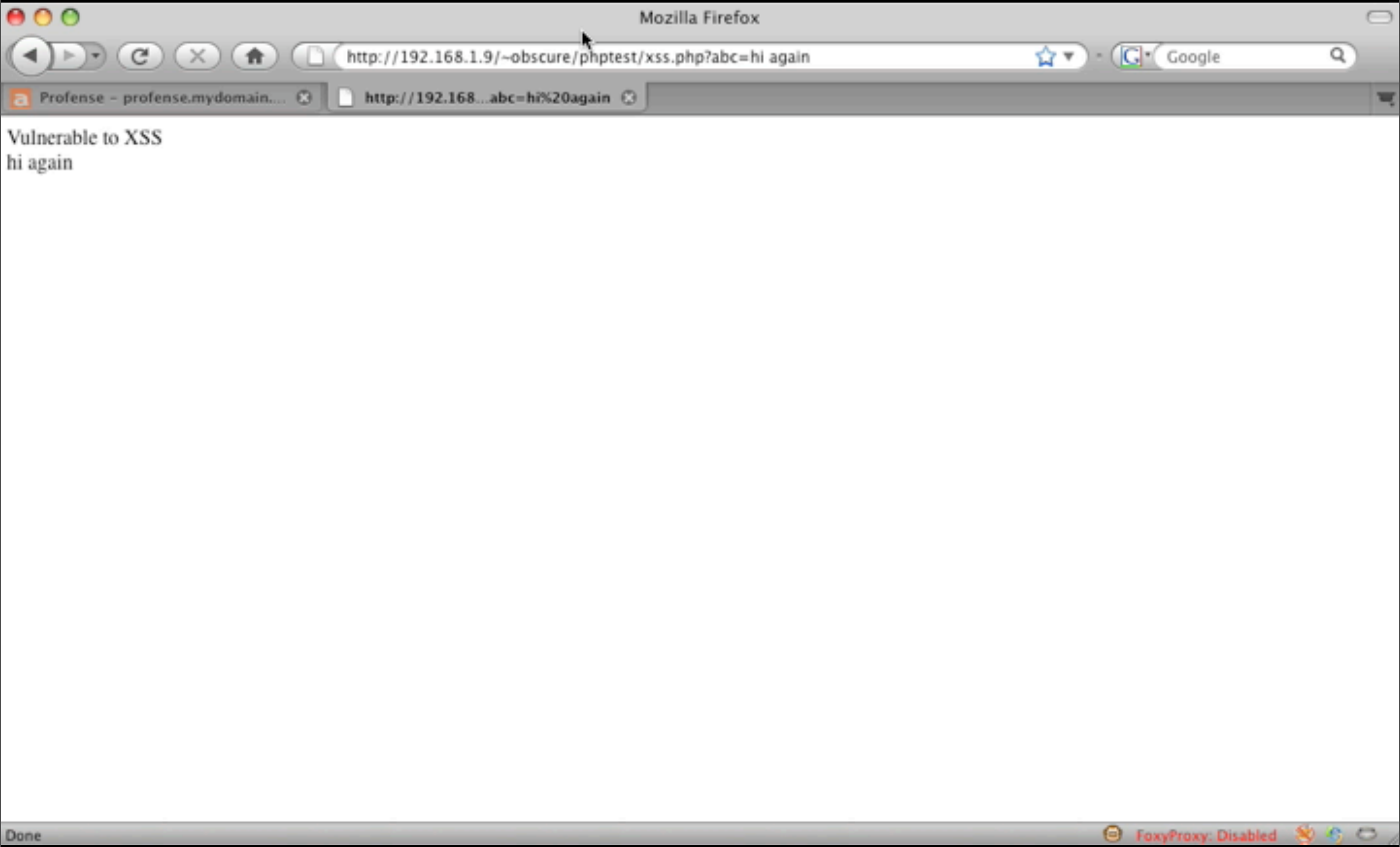


Mozilla Firefox
http://192.168.1.9/~obscure/phptest/xss.php?abc=I Am XSSable
Google
Profense - profense.mydomain...
http://192.168...0Am%20XSSable
Done
FoxyProxy: Disabled

Vulnerable to XSS
I Am XSSable

# The positive model

- It’s well known that the negative model is broken
- What about positive model?
- They are really secure?
- If we find a positive model should we give up?

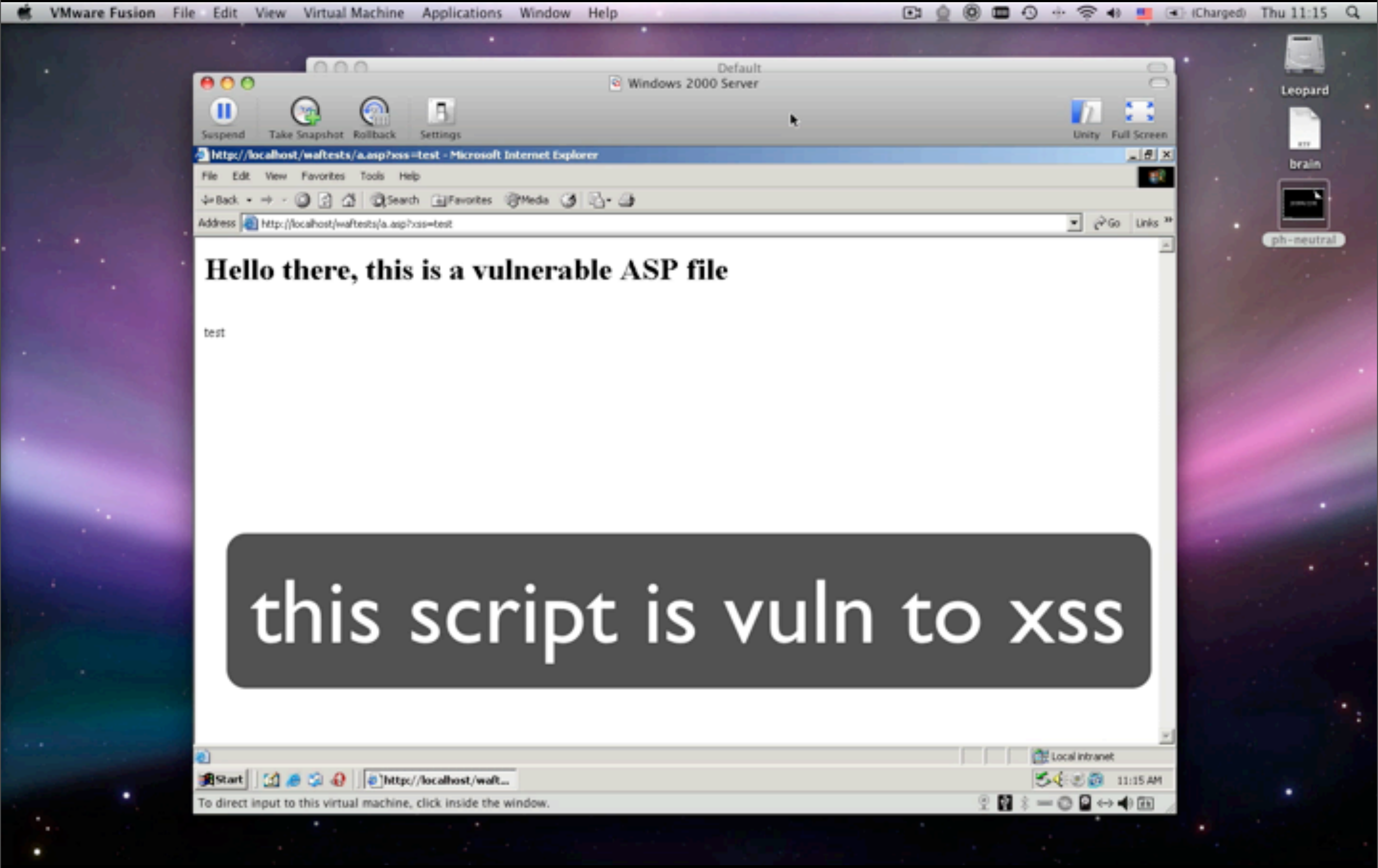


Mozilla Firefox
http://192.168.1.9/~obscure/phptest/xss.php?abc=hi again
Google
Profense - profense.mydomain....
http://192.168...abc=hi%20again
Done
FoxyProxy: Disabled

Vulnerable to XSS
hi again

# Testing WAFs for bypasses is a tedious job

- Which is why we automate it :-)
- WAFFUN - works in progress
  - Checks if the script echos back (esp in the case of xss)
  - Can check if error suppression is supported
  - Finds out how the WAF responds when a it reacts to an attack
  - Goes through a list of well known blacklisted strings
  - If any were blocked, it tries different encoding methods, null characters, unicode



http://localhost/waftests/a.asp?xss=test - Microsoft Internet Explorer

Address: http://localhost/waftests/a.asp?xss=test

Hello there, this is a vulnerable ASP file

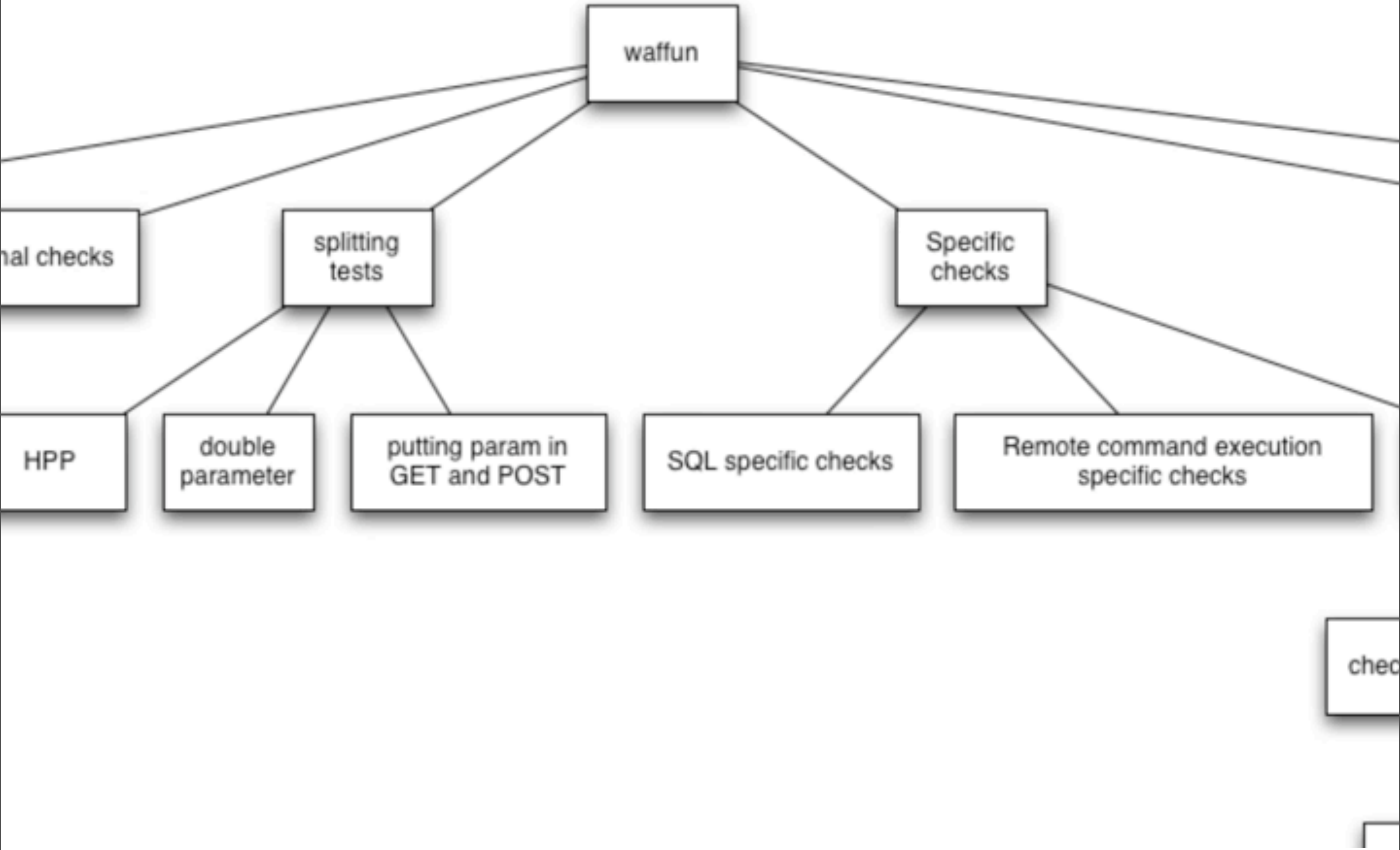
test

To direct input to this virtual machine, click inside the window.

this script is vuln to xss

# WAFFUN: XSS constructor

- Tries a number of tags to find out which are allowed through
- Tries a number of DHTML event handlers
- Tries a number of Javascript methods

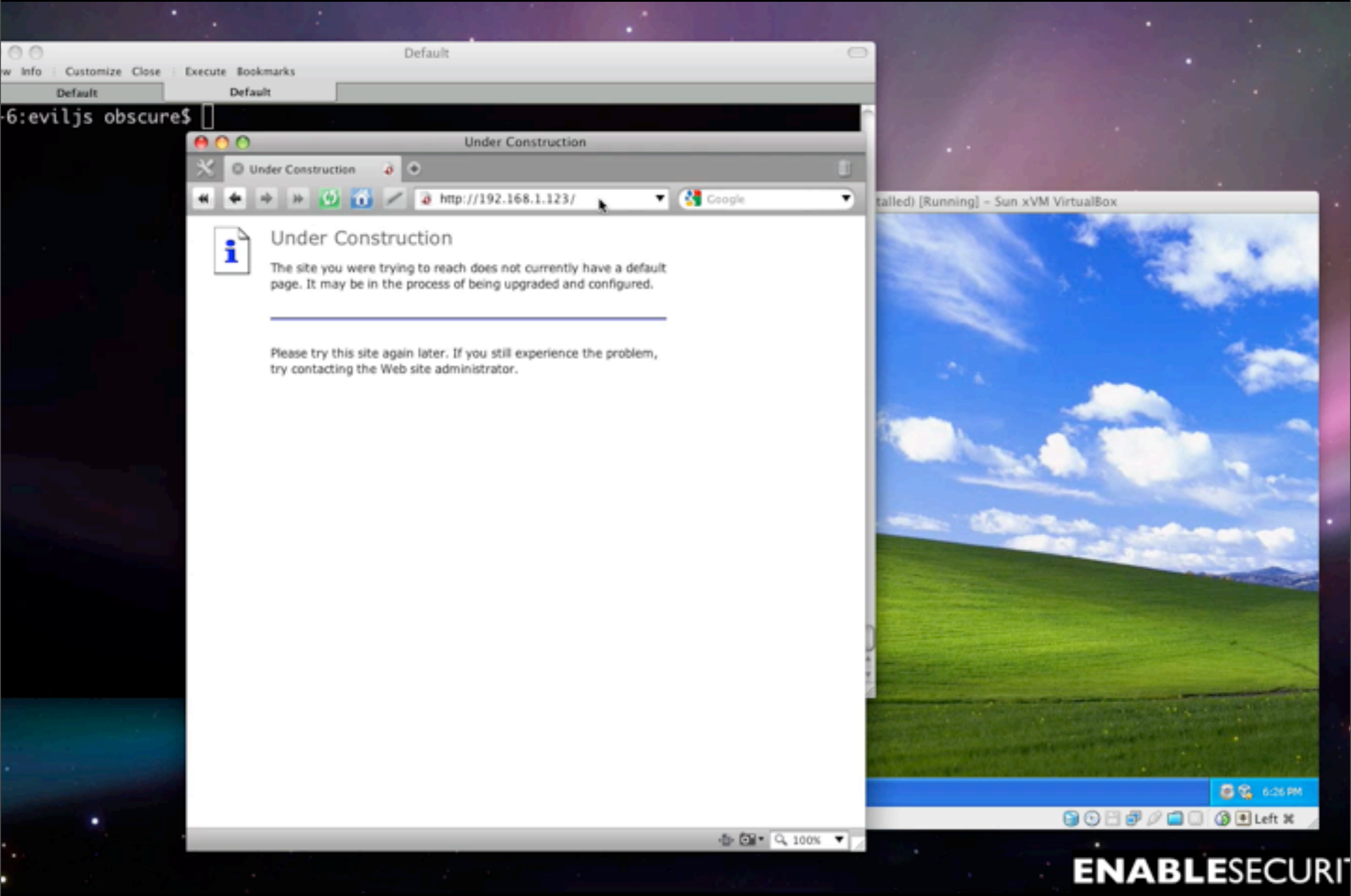

waffun
nal checks
splitting tests
Specific checks
HPP
double parameter
putting param in GET and POST
SQL specific checks
Remote command execution specific checks
chec

# WAFs may be vulnerable too!

- Security software is not necessarily secure
- Web Application specific issues: XSS, SQLi
- Overflows
- DoS

# Known issues

- ModSecurity 2.5.9
  - addresses 2 vulnerabilities
    - "Fixed PDF XSS issue where a non-GET request for a PDF file would crash the Apache httpd process."
    - "Fixed parsing multipart content with a missing part header name which would crash Apache."
- Profense 2.6.3
  - Profense Web Application Firewall Cross-Site Scripting and Cross-Site Request Forgery
- DotDefender 3.8-5 (this week)
  - Command Execution in dotDefender Site Management
    - (requires authentication)
    - seems like it is vulnerable to XSRF



```
-6:eviljs obscure$ 
```

## Under Construction

The site you were trying to reach does not currently have a default page. It may be in the process of being upgraded and configured.

Please try this site again later. If you still experience the problem, try contacting the Web site administrator.

ENABLESECURIT

Friday, 4 December 2009

# Thank you

- Do you have ideas / resources to improve our tools?
- wsguglielmetti [em] gmail [ponto] com
- sandro [em] enablesecurity [ponto] com
- Questions?