Applications Assessment

Vulnerability Assessment Course
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Agenda

- Introduction
- Application – what is it? Why do we care?
- Assessment preparations
- Application assessment tools
- Application Vulnerabilities
- Lab: Spider and scan a Web application
Some Assumptions

- This is just the starting point – an introduction
- Not all risks discussed
- Application testing is hard and time consuming
- We can't cover everything
- Not here to debate terminology
The Problem

■ You have applications…
■ Your applications have weaknesses!!
■ How do you know what weaknesses they contain?
■ Application vulnerability assessment will help you find them…

State Of Application Security: Nearly 60 Percent Of Apps Fail First Security Test

Veracode app-testing data demonstrates that application security still has a ways to go.

By Kelly Jackson Higgins, Dark Reading
March 1, 2010
URL: http://www.darkreading.com/story/showArticle.jhtml?articleID=223100875

SAN FRANCISCO -- RSA Conference 2010 -- Even with all of the emphasis on writing software with security in mind, most software applications remain riddled with security holes, according to a new report released today about the actual security quality of all types of software.

Around 58 percent of the applications tested by application security testing service provider Veracode in the past year-and-a-half failed to achieve a successful rating in their first round of testing. "The degree of failure to meet acceptable standards on first submission is astounding -- and this is coming from folks who are brave enough to submit their software to our [application security testing] services," says Roger Chen, senior vice president of marketing for Veracode. "The implication here is that more than half of all applications are susceptible to the kinds of vulnerabilities we saw at Heartland, Google, DOD, and others -- there were all application-layer attacks."
Applications

- Distinguish from system/infrastructure
- Provide business logic to support functionality of/for an organization
  - Enterprise level
    - Examples may include accounting, personnel, payroll
  - Department level
    - Examples may include resource management, information management
Understanding Each Other
Application Vulnerabilities

- Unauthenticated or unauthorized access
  - Viewing
  - Modifying
  - Deleting

- Failure to enforce security controls
  - Secure communication
  - Password length, complexity, age, history
  - Least privilege
  - Session management, lockout, termination
  - Hard-coded or default password
  - Inactive, temporary, training, test, demo accounts
  - Input validation

Pretty simple, right?
Application Attack Vectors

- Parameter manipulation
- Script and SQL injection
- Session management
- Interception
- Malware
- Buffer overflow

All found in the **CWE/SANS Top 25 Programming Errors**
The Result

U.S. Treasury Website Hacked Using Exploit Kit

May 4

Posted on OSNews by Sean Paul Correll

(15) Comments

Updated at 8PM PST 5/3/2010 — Added information about Roguewave and two additional government sites affected

Time and time again we talk about how amateur and professional hackers alike are able to use automated tools which can identify security vulnerabilities on a computer and exploit them with little or no technical skill necessary for the other criminal. The spotted coral ladders behind these kits have been running on the Internet, as many of the kits available can be downloaded in underground forums for free. Today, we came across an embedded frame inside of the Department of Treasury website. This frame (noticed below) is used to silently load one of the longer exploit kits main URLs, which in turn determines what the best available exploitation method for the browser accessing the site.

```javascript
function addCookie(name, value, hours)
{
   var date = new Date();
   date.setTime(date.getTime() + (hours*3600000));
   var expires = ""; expires="date.toGMTString()";
   document.cookie = name +=value+expires+"; path=/";
}
```

Injected IFRAME

U.S. Army Website Hacked

SQL injection, plain-text passwords leave databases exposed

By Kelly Janssen Higgins, DarkReading

Jun 17, 2010

URL: http://www.darkreading.com/story/showArticle.jhtml?articleID=22300588

Romanian hackers continue to have a field day with SQL injection flaws in major Websites and applications. A vulnerability in a U.S. Army Website that leaves the database wide open to an attacker has now been exposed.

"TimKode," a Romanian hacker who previously found holes in NASA's Website, has posted a proof-of-concept on his findings on a SQL injection vulnerability in an Army Website that handles public housing. Army Housing OneStop. TimKode found a hole that leaves the site, which has since been taken offline, vulnerable to a SQL injection attack. "With this vulnerability I can reconstruct all things from databases," he blogged.

TimKode was able to gain access to more than 75 databases on the server, according to his research, including potentially confidential Army data. He also discovered that the housing site was storing weak passwords in plaintext. One password was AHOS, like the site's name.
Some Things to Ponder

- Looking at and using the application in ways a "normal" user would not
  - Exposes weaknesses
  - Bad guys don’t follow rules
  - Problems due to unintentional user actions
- Use the expected client environment...but also try "unexpected" environments
- Phased application implementation
- Assessment location
- How long should it take?
Caveats

- Production versus development environments
  - Potential to modify production data
  - In some cases production is preferable
  - Advantages of manual testing over automated tools

- Impact of specific testing

- Development or test systems that mimic production

- Some testing can only be performed in production
Methodology

- Phase 1 – Planning
- Phase 2 – Information Collection
- Phase 3 – Enumeration
- Phase 4 – Testing and Evaluation
- Phase 5 – Reporting
Required Information

- Business description of the application
  - Purpose/function – business rules
  - Types of information
  - Types of Users/Roles
    - Users and their locations

- Technical description
  - All methods of access
  - Site URLs as applicable
  - Application Account(s)
    - All roles, including administrator/super user
  - Data flow/transaction logic/use cases
Application Familiarization

- What is the application’s purpose?
  - What does the application evaluator know about the business processes?
- Who are its users?
  - Are there various user roles with distinctive privileges?
- How is it accessed?
- What are the underlying technologies?

What is **most** important? What, if not working properly, would cause **major** problems? What are the **critical** functions?
Basic Tools – Yours or The System Owner’s

- Web Browser
- Application Proxy
- Network Protocol Analyzer

Tools are not THE solution!
They don’t understand business logic and produce false positives...
Additional Online Tools

■ Google Hacking
  – Using Google to search publicly accessible Web applications for vulnerabilities and to discover sensitive information
    ■ site:<webapp> filetype:doc (try other file extensions too)
      ● Example: site:yahoo.com filetype:xls

■ Netcraft – http://www.netcraft.com/

Methodology

- Phase 1 – Planning
- Phase 2 – Information Collection
- Phase 3 – Enumeration
- Phase 4 – Testing and Evaluation
- Phase 5 – Reporting
Application Mapping

- Now that you have your hands on the application, you *really* get to see what's what
- Discover application functionality
  - Identify channels for user input
  - Identify implemented security controls
  - Determine where critical data resides
  - “Reality" doesn't always match the documentation
  - Lack of or incomplete documentation
Methodology

- Phase 1 – Planning
- Phase 2 – Information Collection
- Phase 3 – Enumeration
- **Phase 4 – Testing and Evaluation**
- Phase 5 – Reporting
Information Exposures – Hidden Functionality
Malicious File Uploads

- Web applications that accept file uploads may present Trojan or directory traversal vulnerabilities
  - Type of file should be restricted to only those required
  - Text is the only safe file type left
Account Lockout and Session Inactivity

■ Account Lockout
  – Number of failed attempts
  – Length of lockout
  – Client-side processing
  – Automatic lockout for unused account

■ Termination of session due to inactivity or logout
Force Errors in the Application

- Errors can reveal application weaknesses
Authentication Issues

- Length
- Complexity
  - Dictionary words
- History
- Aging
  - Minimum days
  - Maximum days
- Error messages
- Client-side processing
- Hard-coded passwords
Change User Passwords

- Attempt to substitute parameters that are passed from the client to the server when a password change is made
- Attempt to reset passwords by guessing answers to easy “security” questions
- Account enumeration
  - Published technique
  - Login error messages
  - Brute force
Session State

- A chain of trust

- HTTP is a stateless protocol, therefore Web servers respond to client requests without coupling them together

- Valid Session token exposure may permit a malicious user to take over the session

- Session Exercise
Data Transmission Confidentiality

- Protecting data in transit
  - Application data
  - Session tokens
Business Logic and Workflows

- **Validate Business Logic**
  - Hardest risk to detect...application walk-through helps
  - Cannot be detected by vulnerability scanners
  - Assumptions by developers...requires creative thinking
    - Parameter manipulation
    - Perform steps 1, 2, 3 in order, what happens if step 2 is skipped
    - Level=1, role=user, etc
    - http://<testurl>/admin/ or http://<testurl>/pwdchange/

- **Impact examples**
  - Horizontal and vertical role escalation
  - Unauthorized process flows

What is **most** important? What, if not working properly, would cause **major** problems? What are the **critical** functions?
Input Validation

- Lack of input validation results in code insertion via user supplied data
- Caused when...
  - User input incorrectly filtered can result in executed code
  - User input is not strongly typed and thereby unexpectedly executed
- User input cannot be trusted
- Client-side validation inadequate
Cross Site Scripting (XSS)

- Code injection attack into the various interpreters in the Web browser
  - HTML, JavaScript, VBScript, ActiveX, Flash, etc.

- Types
  - Persistent
  - Non-Persistent

- Used for...
  - Account hijacking
  - Changing user settings
  - Cookie theft/poisoning
  - Denial of Service
  - Scanning for vulnerabilities
SQL Injection

1. Application presents a form to the attacker
2. Attacker sends SQL code in the form data
3. Application forwards code to the database in a SQL query
4. Database runs query containing attack code and sends results back to application
5. Application sends results to the attacker

Derived from OWASP AppSec DC 2009 presentation by Dave Wichers
Lab 1 and 2 – Hidden Information

■ Getting started
  - Open Student Windows VM … password is “guest”
  - Click “WebGoat Server”
  - Open “WebGoat User”
  - Log in as "guest" ... password is “guest”

■ Lab 1 – Instructor Guided
  - Code Quality … Discover Clues in the HTML

■ Lab 2 – Instructor Guided
  - Parameter Tampering … Exploit Hidden Fields
Lab 3 – Web Application Tools

■ Getting started
  – Open Student Windows VM ... password is “guest”
  – Click “WebGoat Server”
  – Open “WebGoat User”
  – Log in as "guest" ... password is “guest”
  – Open Paros

■ Lab 3 – Instructor Guided
  – Use Paros to spider WebGoat, then scan
Questions
Additional Labs (all student driven)

- Lab 1: URL manipulation (privilege escalation)
  - Access Control Flaws » Remote Admin Access
- Lab 2: URL manipulation (hidden functionality)
  - Insecure Configuration » Forced Browsing
- Lab 3: SSL (insecure communications)
  - Authentication Flaws » Basic Authentication
- Lab 5: Directory traversal
  - Access Control Flaws » Bypass a Path Based Access Control Scheme
- Lab 1: SQL injection
  - Injection Flaws » Numeric SQL Injection
- Lab 2: SQL injection
  - Injection Flaws » String SQL Injection
- Lab 3: XSS
  - Cross-Site Scripting (XSS) » Stored XSS Attacks
- Lab 4: Client-side validation