OWASP Top 10 – 2010

The Top 10 Most Critical Web Application Security Risks

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

What's Changed?

It's About Risks, Not Just Vulnerabilities

- New title is: "The Top 10 Most Critical Web Application Security Risks"

OWASP Top 10 Risk Rating Methodology

- Based on the OWASP Risk Rating Methodology, used to prioritize Top 10

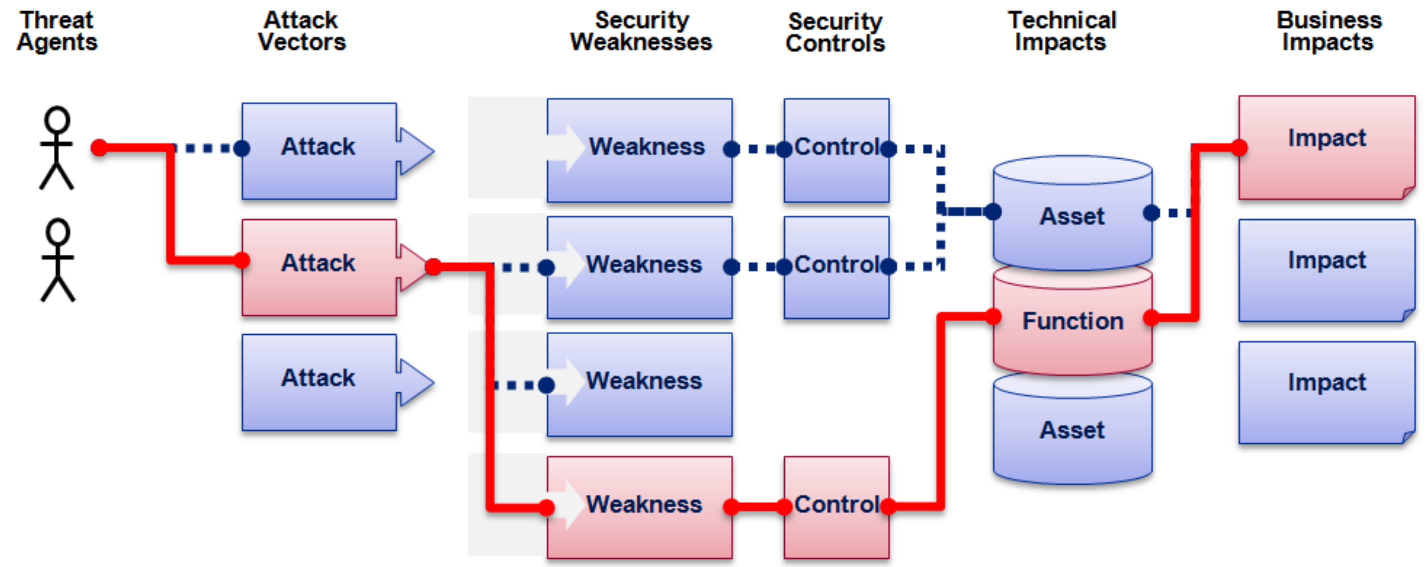
2 Risks Added, 2 Dropped

- **Added: A6 – Security Misconfiguration**
  - Was A10 in 2004 Top 10: Insecure Configuration Management
- **Added: A10 – Unvalidated Redirects and Forwards**
  - Relatively common and VERY dangerous flaw that is not well known
- **Removed: A3 – Malicious File Execution**
  - Primarily a PHP flaw that is dropping in prevalence
- **Removed: A6 – Information Leakage and Improper Error Handling**
  - A very prevalent flaw, that does not introduce much risk (normally)

Mapping from 2007 to 2010 Top 10

OWASP Top 10 – 2007 (Previous)		OWASP Top 10 – 2010 (New)
A2 – Injection Flaws	↑	A1 – Injection
A1 – Cross Site Scripting (XSS)	↓	A2 – Cross Site Scripting (XSS)
A7 – Broken Authentication and Session Management	↑	A3 – Broken Authentication and Session Management
A4 – Insecure Direct Object Reference	=	A4 – Insecure Direct Object References
A5 – Cross Site Request Forgery (CSRF)	=	A5 – Cross Site Request Forgery (CSRF)
<was T10 2004 A10 – Insecure Configuration Management>	+	A6 – Security Misconfiguration (NEW)
A8 – Insecure Cryptographic Storage	↑	A7 – Insecure Cryptographic Storage
A10 – Failure to Restrict URL Access	↑	A8 – Failure to Restrict URL Access
A9 – Insecure Communications	=	A9 – Insufficient Transport Layer Protection
<not in T10 2007>	+	A10 – Unvalidated Redirects and Forwards (NEW)
A3 – Malicious File Execution	−	<dropped from T10 2010>
A6 – Information Leakage and Improper Error Handling	−	<dropped from T10 2010>

OWASP Top 10 Risk Rating Methodology



Threat Agent		Attack Vector	Weakness Prevalence	Weakness Detectability	Technical Impact	Business Impact
	1	Easy	Widespread	Easy	Severe	
?	2	Average	Common	Average	Moderate	?
	3	Difficult	Uncommon	Difficult	Minor	
		1	2	2	1	

$$\underbrace{1 \quad 2 \quad 2}_{1.66} \qquad 1$$

Injection Example

$$\underbrace{1.66 \quad * \quad 1}_{1.66 \text{ weighted risk rating}}$$

1.66 weighted risk rating

OWASP Top Ten (2010 Edition)

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

OWASP
The Open Web Application Security Project
http://www.owasp.org

http://www.owasp.org/index.php/Top_10

A1 – Injection

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, Hibernate, etc…

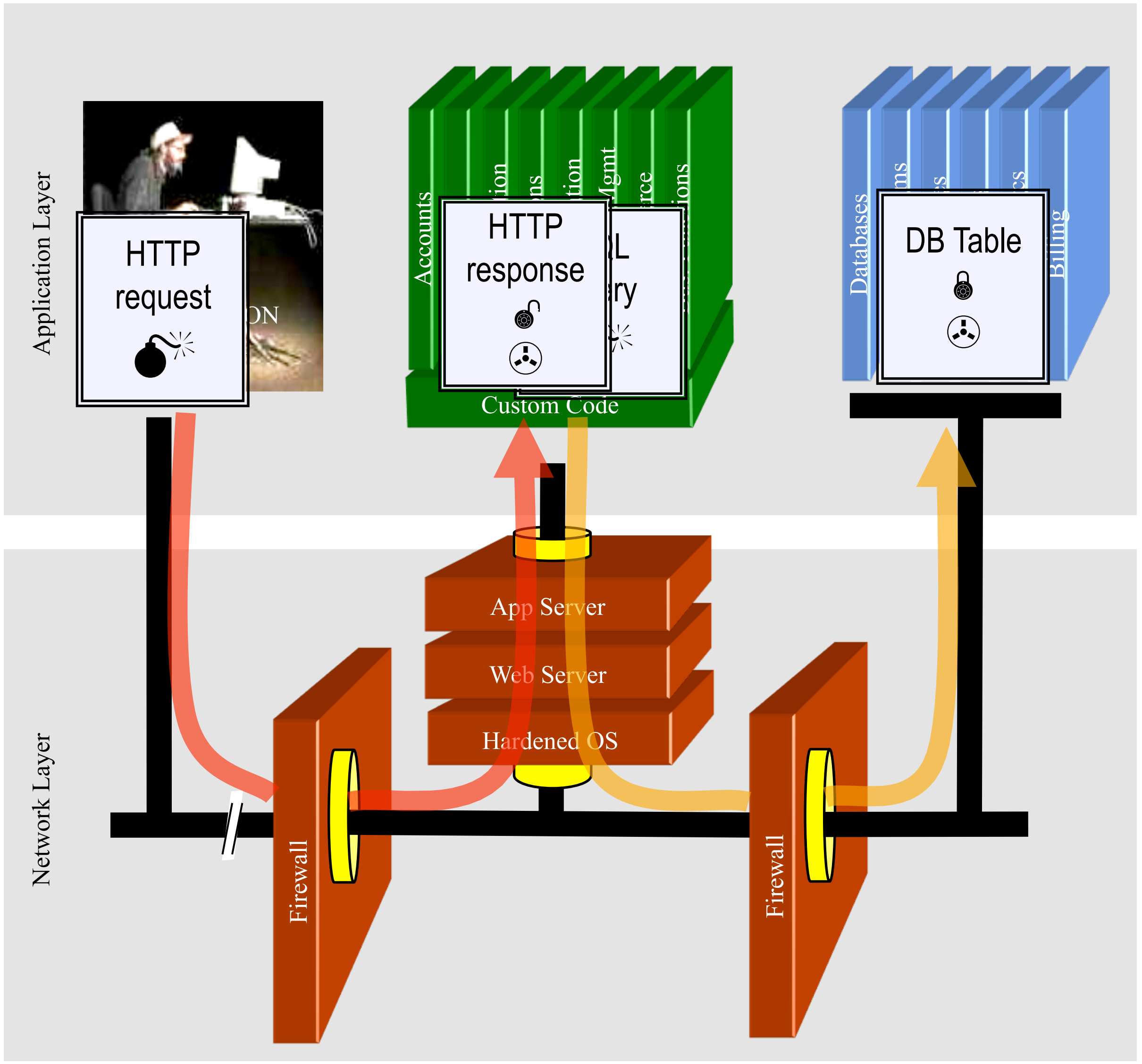
SQL injection is still quite common

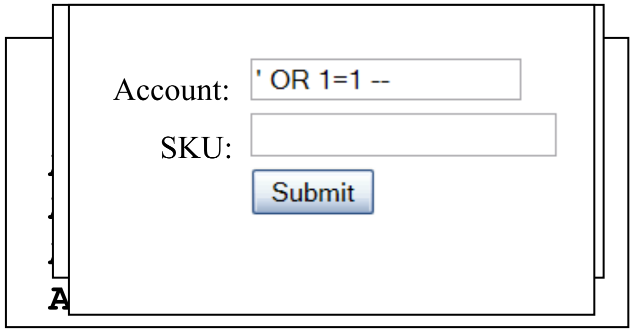
- Many applications still susceptible (really don't know why)
- Even though it's usually very simple to avoid

Typical Impact

- Usually severe. Entire database can usually be read or modified
- May also allow full database schema, or account access, or even OS level access

SQL Injection – Illustrated





Account: ' OR 1=1 --

SKU:

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

A1 – Avoiding Injection Flaws

- Recommendations
  1. Avoid the interpreter entirely, or
  2. Use an interface that supports bind variables (e.g., prepared statements, or stored procedures),
     - Bind variables allow the interpreter to distinguish between code and data
  3. Encode all user input before passing it to the interpreter
  - Always perform 'white list' input validation on all user supplied input
  - Always minimize database privileges to reduce the impact of a flaw

- References
  - For more details, read the new http://www.owasp.org/index.php/SQL_Injection_Prevention_Cheat_Sheet

A2 – Cross-Site Scripting (XSS)

Occurs any time…

- Raw data from attacker is sent to an innocent user’s browser

Raw data…

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

Virtually <u>every</u> web application has this problem

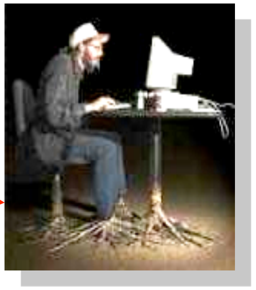
- Try this in your browser – javascript:alert(document.cookie)

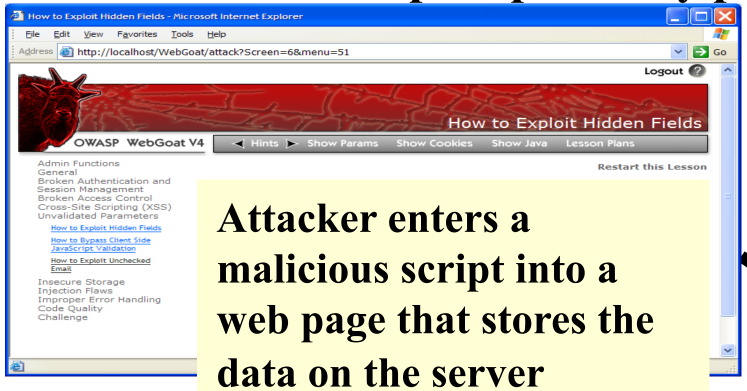
Typical Impact

- Steal user’s session, steal sensitive data, rewrite web page, redirect user to phishing or malware site
- Most Severe: Install XSS proxy which allows attacker to observe and direct all user’s behavior on vulnerable site and force user to other sites

Cross-Site Scripting Illustrated

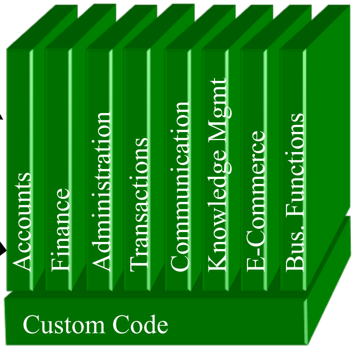
1 Attacker sets the trap – update my profile



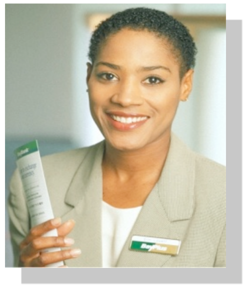

How to Exploit Hidden Fields - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/WebGoat/attack?Screen=6&menu=51
Logout
How to Exploit Hidden Fields
OWASP WebGoat V4
Hints Show Params Show Cookies Show Java Lesson Plans
Admin Functions
General
Broken Authentication and Session Management
Broken Access Control
Cross-Site Scripting (XSS)
Unvalidated Parameters
How to Exploit Hidden Fields
How to Bypass Client Side JavaScript Validation
How to Exploit Unchecked Email
Insecure Storage
Injection Flaws
Improper Error Handling
Code Quality
Challenge
Restart this Lesson

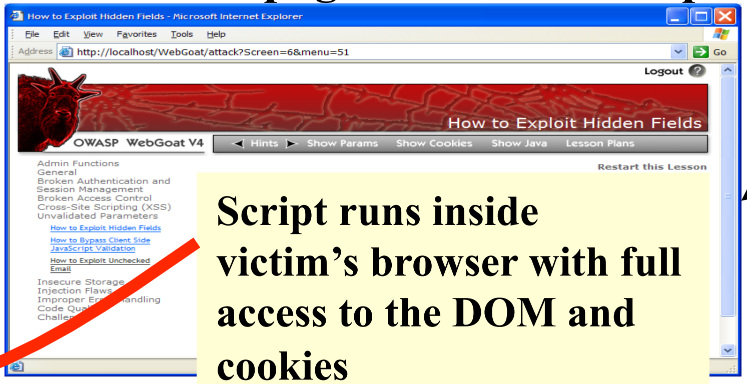
Attacker enters a malicious script into a web page that stores the data on the server

Application with stored XSS vulnerability



2 Victim views page – sees attacker profile

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Restart this Lesson

Script runs inside victim's browser with full access to the DOM and cookies

3 Script silently sends attacker Victim's session cookie

A2 – Avoiding XSS Flaws

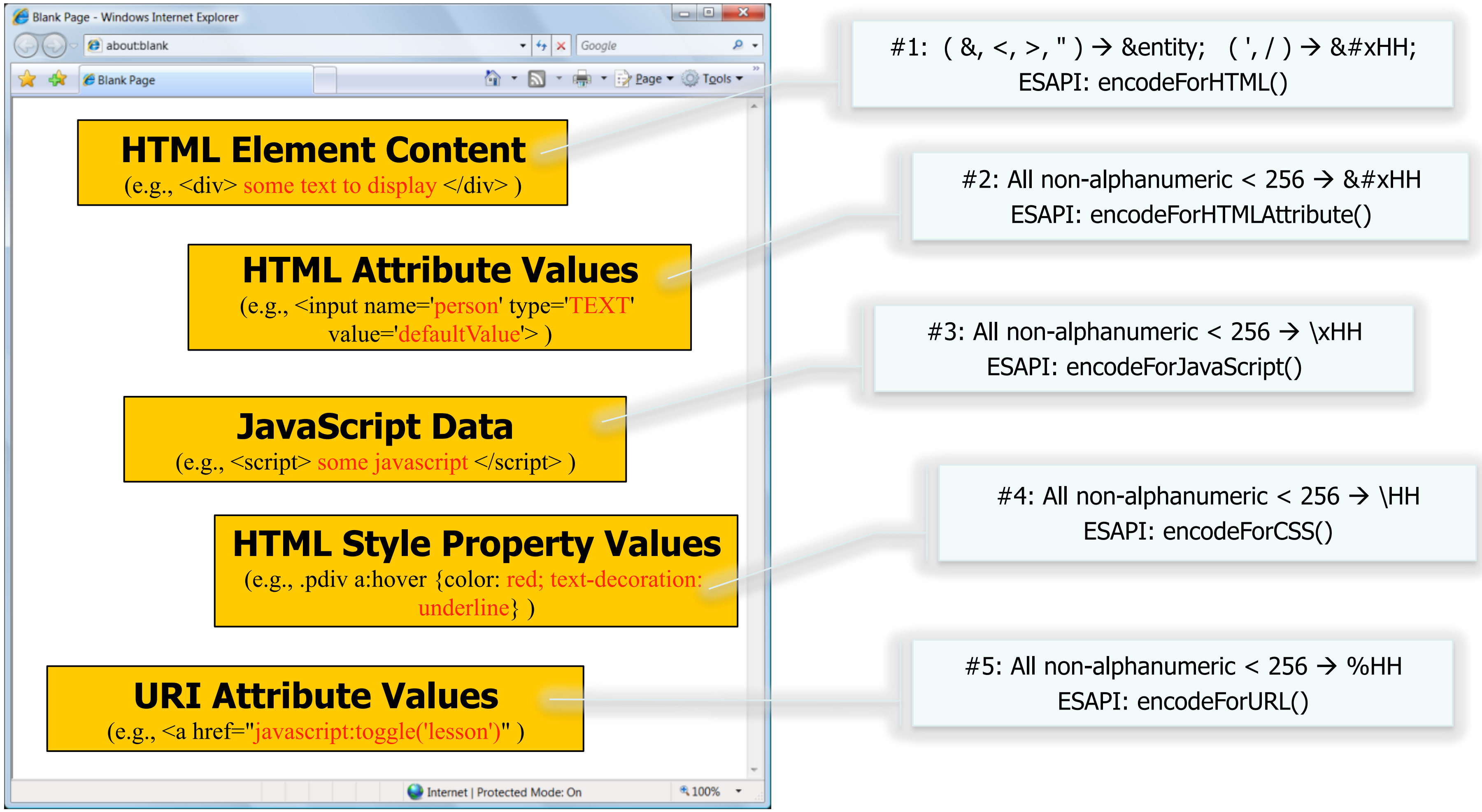
- Recommendations
  - Eliminate Flaw
    - Don’t include user supplied input in the output page
  - Defend Against the Flaw
    - Primary Recommendation: Output encode all user supplied input (Use OWASP’s ESAPI to output encode:

      http://www.owasp.org/index.php/ESAPI
    - Perform ‘white list’ input validation on all user input to be included in page
    - For large chunks of user supplied HTML, use OWASP’s AntiSamy to sanitize this HTML to make it safe

      See: http://www.owasp.org/index.php/AntiSamy
- References
  - For how to output encode properly, read the new http://www.owasp.org/index.php/XSS_(Cross Site Scripting) Prevention Cheat Sheet

(AntiSamy)

Safe Escaping Schemes in Various HTML Execution Contexts


Blank Page - Windows Internet Explorer
about:blank
Google
Blank Page
Page
Tools
Internet | Protected Mode: On
100%

HTML Element Content
(e.g., <div> some text to display </div>)

HTML Attribute Values
(e.g., <input name='person' type='TEXT' value='defaultValue'>)

JavaScript Data
(e.g., <script> some javascript </script>)

HTML Style Property Values
(e.g., .pdiv a:hover {color: red; text-decoration: underline})

URI Attribute Values
(e.g., <a href="javascript:toggle('lesson')")

#1: (&, <, >, ") → &entity; (', /) → &#xHH;
ESAPI: encodeForHTML()

#2: All non-alphanumeric < 256 → &#xHH
ESAPI: encodeForHTMLAttribute()

#3: All non-alphanumeric < 256 → \xHH
ESAPI: encodeForJavaScript()

#4: All non-alphanumeric < 256 → \HH
ESAPI: encodeForCSS()

#5: All non-alphanumeric < 256 → %HH
ESAPI: encodeForURL()

ALL other contexts CANNOT include Untrusted Data

Recommendation: Only allow #1 and #2 and disallow all others

See: www.owasp.org/index.php/XSS_(Cross_Site_Scripting)_Prevention_Cheat_Sheet for more details

A3 – Broken Authentication and Session Management

HTTP is a "stateless" protocol

- Means credentials have to go with every request
- Should use SSL for everything requiring authentication

Session management flaws

- SESSION ID used to track state since HTTP doesn't
  - and it is just as good as credentials to an attacker
- SESSION ID is typically exposed on the network, in browser, in logs, …

Beware the side-doors

- Change my password, remember my password, forgot my password, secret question, logout, email address, etc…

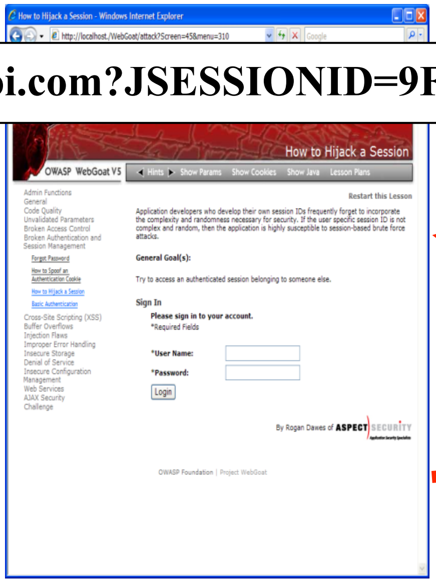
Typical Impact

- User accounts compromised or user sessions hijacked

Broken Authentication Illustrated

1 User sends credentials

www.boi.com?JSESSIONID=9FA1DB9EA...



Application developers who develop their own session IDs frequently forget to incorporate the complexity and randomness necessary for security. If the user specific session ID is not complex and random, then the application is highly susceptible to session-based brute force attacks.

General Goal(s):

Try to access an authenticated session belonging to someone else.

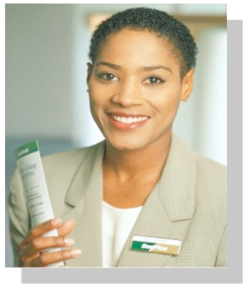
Sign In

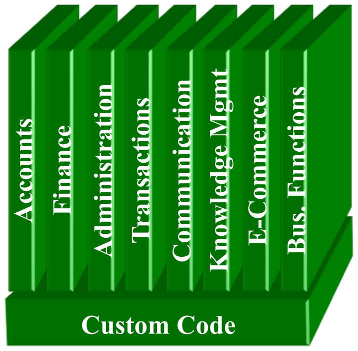
Please sign in to your account.
*Required Fields

*User Name:
*Password:

By Rogan Dawes of ASPECT SECURITY

OWASP Foundation | Project WebGoat

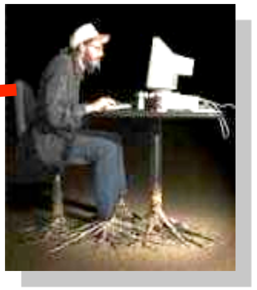




Site uses URL rewriting (i.e., put session in URL) 2

3 User clicks on a link to http://www.hacker.com in a forum

Hacker checks referer logs on www.hacker.com and finds user's JSESSIONID 4



5 Hacker uses JSESSIONID and takes over victim's account

A3 – Avoiding Broken Authentication and Session Management

- Verify your architecture
  - Authentication should be simple, centralized, and standardized
  - Use the standard session id provided by your container
  - Be sure SSL protects both credentials and session id at all times

- Verify the implementation
  - Forget automated analysis approaches
  - Check your SSL certificate
  - Examine all the authentication-related functions
  - Verify that logoff actually destroys the session
  - Use OWASP's WebScarab to test the implementation

- Follow the guidance from
  - http://www.owasp.org/index.php/Authentication_Cheat_Sheet

A4 – Insecure Direct Object References

How do you protect access to your data?

- This is part of enforcing proper "Authorization", along with A7 – Failure to Restrict URL Access

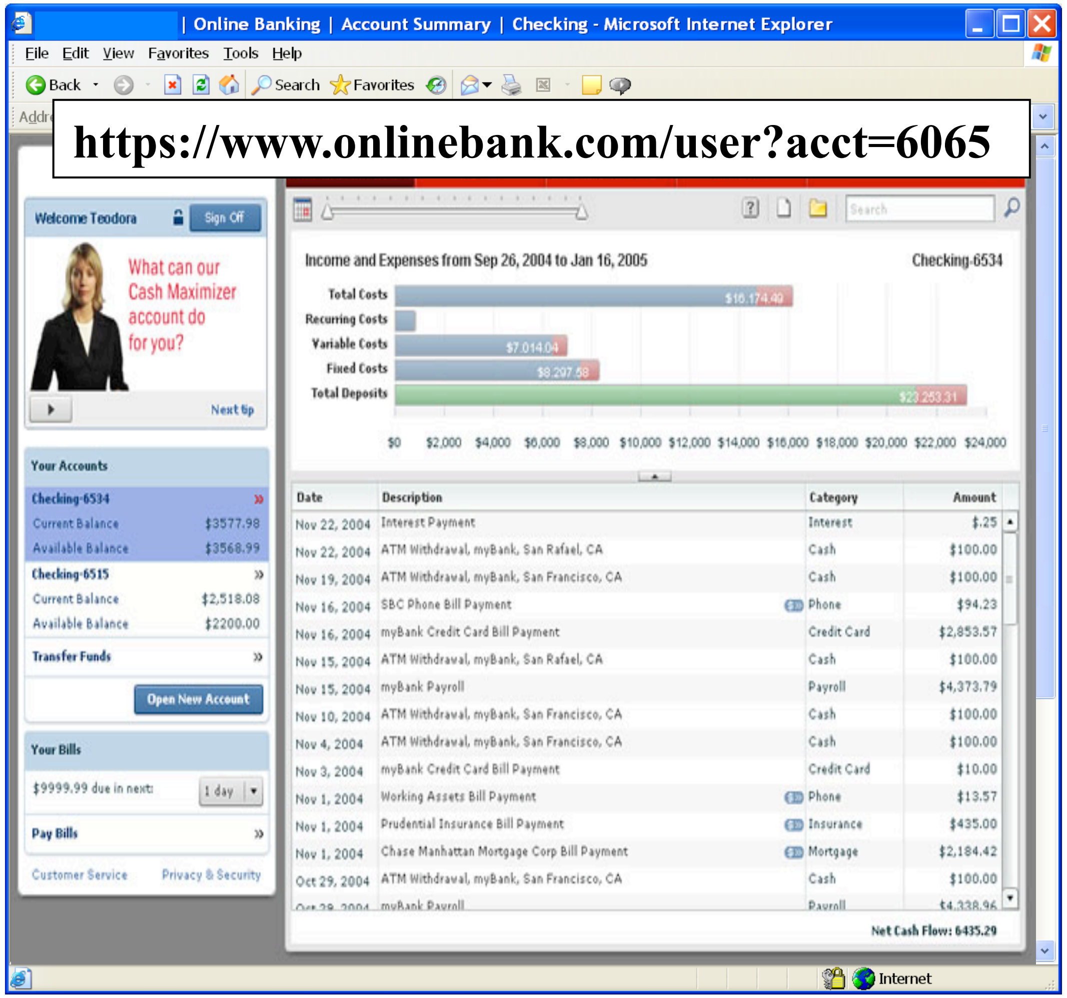
A common mistake …

- Only listing the 'authorized' objects for the current user, or
- Hiding the object references in hidden fields
- … and then not enforcing these restrictions on the server side
- This is called presentation layer access control, and doesn't work
- Attacker simply tampers with parameter value

Typical Impact

- Users are able to access unauthorized files or data

Insecure Direct Object References Illustrated


| Online Banking | Account Summary | Checking - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Search
Internet

https://www.onlinebank.com/user?acct=6065

Welcome Teodora | Sign Off

What can our Cash Maximizer account do for you?

Next tip

Your Accounts

Checking-6534	»
Current Balance	$3577.98
Available Balance	$3568.99
Checking-6515	»
Current Balance	$2,518.08
Available Balance	$2200.00
Transfer Funds	»

Open New Account

Your Bills

$9999.99 due in next: 1 day

Pay Bills »

Customer Service Privacy & Security

Income and Expenses from Sep 26, 2004 to Jan 16, 2005 Checking-6534

Total Costs	$16,174.40
Recurring Costs	
Variable Costs	$7,014.04
Fixed Costs	$8,297.58
Total Deposits	$23,253.31

$0 $2,000 $4,000 $6,000 $8,000 $10,000 $12,000 $14,000 $16,000 $18,000 $20,000 $22,000 $24,000

Date	Description	Category	Amount
Nov 22, 2004	Interest Payment	Interest	$.25
Nov 22, 2004	ATM Withdrawal, myBank, San Rafael, CA	Cash	$100.00
Nov 19, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Nov 16, 2004	SBC Phone Bill Payment	Phone	$94.23
Nov 16, 2004	myBank Credit Card Bill Payment	Credit Card	$2,853.57
Nov 15, 2004	ATM Withdrawal, myBank, San Rafael, CA	Cash	$100.00
Nov 15, 2004	myBank Payroll	Payroll	$4,373.79
Nov 10, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Nov 4, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Nov 3, 2004	myBank Credit Card Bill Payment	Credit Card	$10.00
Nov 1, 2004	Working Assets Bill Payment	Phone	$13.57
Nov 1, 2004	Prudential Insurance Bill Payment	Insurance	$435.00
Nov 1, 2004	Chase Manhattan Mortgage Corp Bill Payment	Mortgage	$2,184.42
Oct 29, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Oct 29, 2004	myBank Payroll	Payroll	$4,338.96

Net Cash Flow: 6435.29

- Attacker notices his acct parameter is 6065

  ?acct=6065

- He modifies it to a nearby number

  ?acct=6066

- Attacker views the victim's account information

A4 – Avoiding Insecure Direct Object References

- Eliminate the direct object reference
  - Replace them with a temporary mapping value (e.g. 1, 2, 3)
  - ESAPI provides support for numeric & random mappings
    - IntegerAccessReferenceMap & RandomAccessReferenceMap

http://app?file=Report123.xls
http://app?file=1

http://app?id=9182374
http://app?id=7d3J93

Access Reference Map

Report123.xls

Acct:9182374

- Validate the direct object reference
  - Verify the parameter value is properly formatted
  - Verify the user is allowed to access the target object
    - Query constraints work great!
  - Verify the requested mode of access is allowed to the target object (e.g., read, write, delete)

A5 – Cross Site Request Forgery (CSRF)

Cross Site Request Forgery

- An attack where the victim's browser is tricked into issuing a command to a vulnerable web application
- Vulnerability is caused by browsers automatically including user authentication data (session ID, IP address, Windows domain credentials, …) with each request

Imagine…

- What if a hacker could steer your mouse and get you to click on links in your online banking application?
- What could they make you do?

Typical Impact

- Initiate transactions (transfer funds, logout user, close account)
- Access sensitive data
- Change account details

CSRF Vulnerability Pattern

- The Problem
  - Web browsers automatically include most credentials with each request
  - Even for requests caused by a form, script, or image on another site

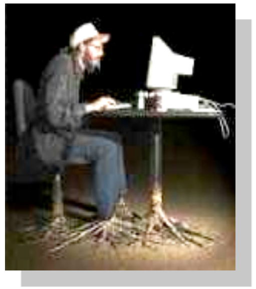
- All sites relying solely on automatic credentials are vulnerable!
  - (almost all sites are this way)

- Automatically Provided Credentials
  - Session cookie
  - Basic authentication header
  - IP address
  - Client side SSL certificates
  - Windows domain authentication

CSRF Illustrated

1

Attacker sets the trap on some website on the internet (or simply via an e-mail)

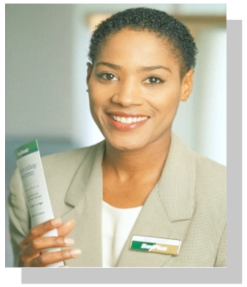


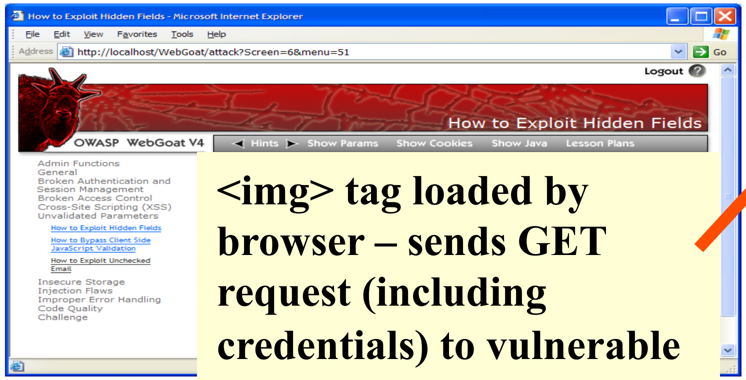
How to Exploit Hidden Fields - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Search
Help Center | Contact Us | ATM/ Banking Stores
View Your Accounts
1. Username:
2. Password:
Username Help
Password Help
3. Sign On to:
Account Summary
Sign On
Need to set up online access?
Sign Up Now or Learn More
About Your New Account
Individuals
Small Business
Commercial

Hidden <img> tag contains attack against vulnerable site

2

While logged into vulnerable site, victim views attacker site

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Address http://localhost/WebGoat/attack?Screen=6&menu=51
Go
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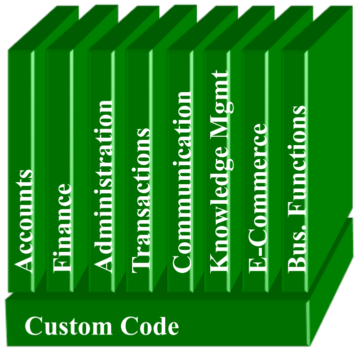
Unvalidated Parameters
How to Exploit Hidden Fields
How to Bypass Client Side JavaScript Validation
How to Exploit Unchecked Email
Insecure Storage
Injection Flaws
Improper Error Handling
Code Quality
Challenge

<img> tag loaded by browser – sends GET request (including credentials) to vulnerable site

Application with CSRF vulnerability



3

Vulnerable site sees legitimate request from victim and performs the action requested

A5 – Avoiding CSRF Flaws

- Add a secret, not automatically submitted, token to ALL sensitive requests
  - This makes it impossible for the attacker to spoof the request
    - (unless there's an XSS hole in your application)
  - Tokens should be cryptographically strong or random

- Options
  - Store a single token in the session and add it to all forms and links
    - **Hidden Field:** `<input name="token" value="687965fdfaew87agrde" type="hidden"/>`
    - **Single use URL:** `/accounts/687965fdfaew87agrde`
    - **Form Token:** `/accounts?auth=687965fdfaew87agrde` **…**
  - Beware exposing the token in a referer header
    - Hidden fields are recommended
  - Can have a unique token for each function
    - Use a hash of function name, session id, and a secret
  - Can require secondary authentication for sensitive functions (e.g., eTrade)

- Don't allow attackers to store attacks on your site
  - Properly encode all input on the way out
  - This renders all links/requests inert in most interpreters

See the new: www.owasp.org/index.php/CSRF_Prevention_Cheat_Sheet
for more details

A6 – Security Misconfiguration

Web applications rely on a secure foundation

- Everywhere from the OS up through the App Server
- Don't forget all the libraries you are using!!

Is your source code a secret?

- Think of all the places your source code goes
- Security should not require secret source code

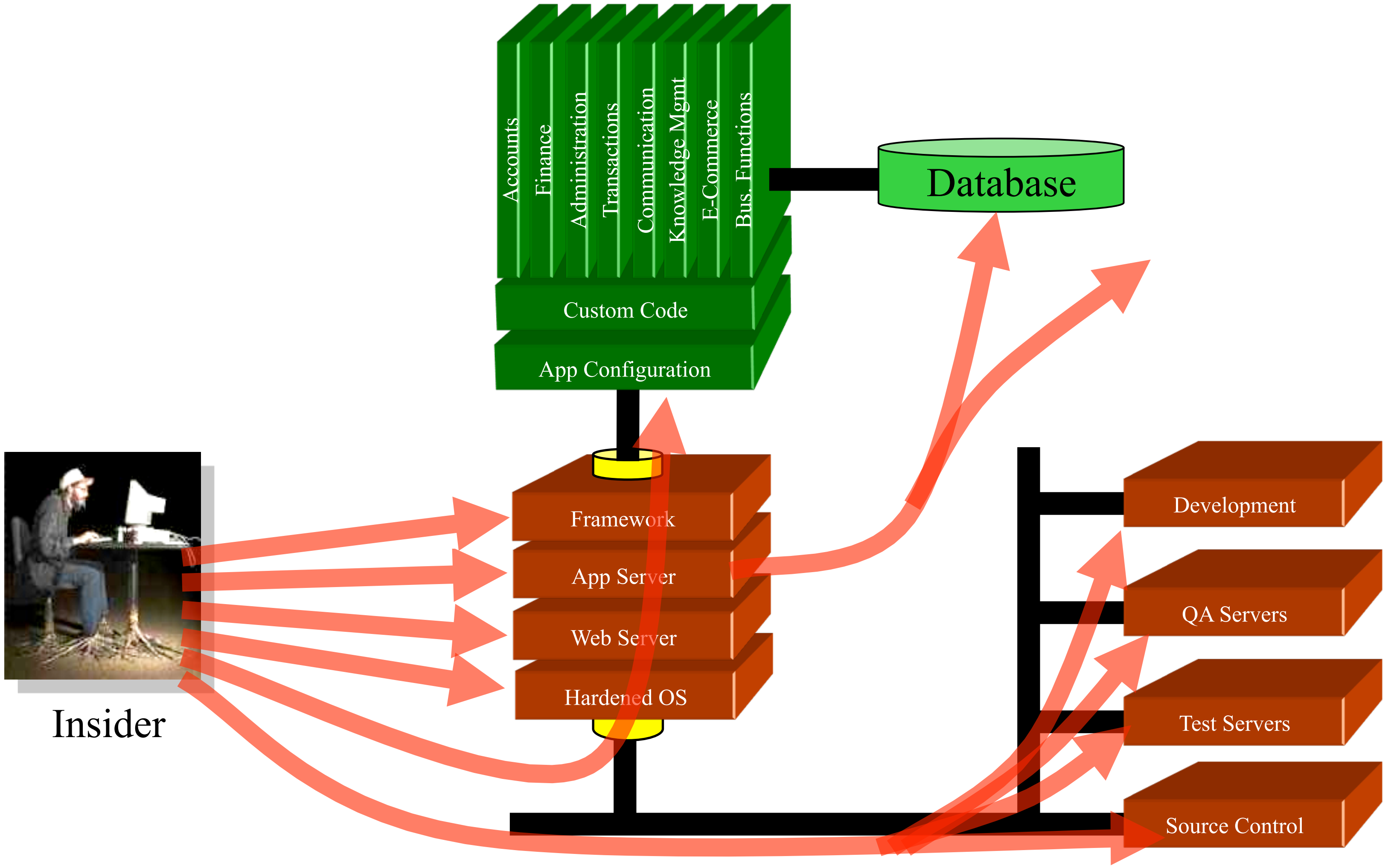
CM must extend to all parts of the application

- All credentials should change in production

Typical Impact

- Install backdoor through missing OS or server patch
- XSS flaw exploits due to missing application framework patches
- Unauthorized access to default accounts, application functionality or data, or unused but accessible functionality due to poor server configuration

Security Misconfiguration Illustrated



A6 – Avoiding Security Misconfiguration

- Verify your system's configuration management
  - Secure configuration "hardening" guideline
    - Automation is REALLY USEFUL here
  - Must cover entire platform and application
  - Keep up with patches for ALL components
    - This includes software libraries, not just OS and Server applications
  - Analyze security effects of changes
- Can you "dump" the application configuration
  - Build reporting into your process
  - If you can't verify it, it isn't secure
- Verify the implementation
  - Scanning finds generic configuration and missing patch problems

A7 – Insecure Cryptographic Storage

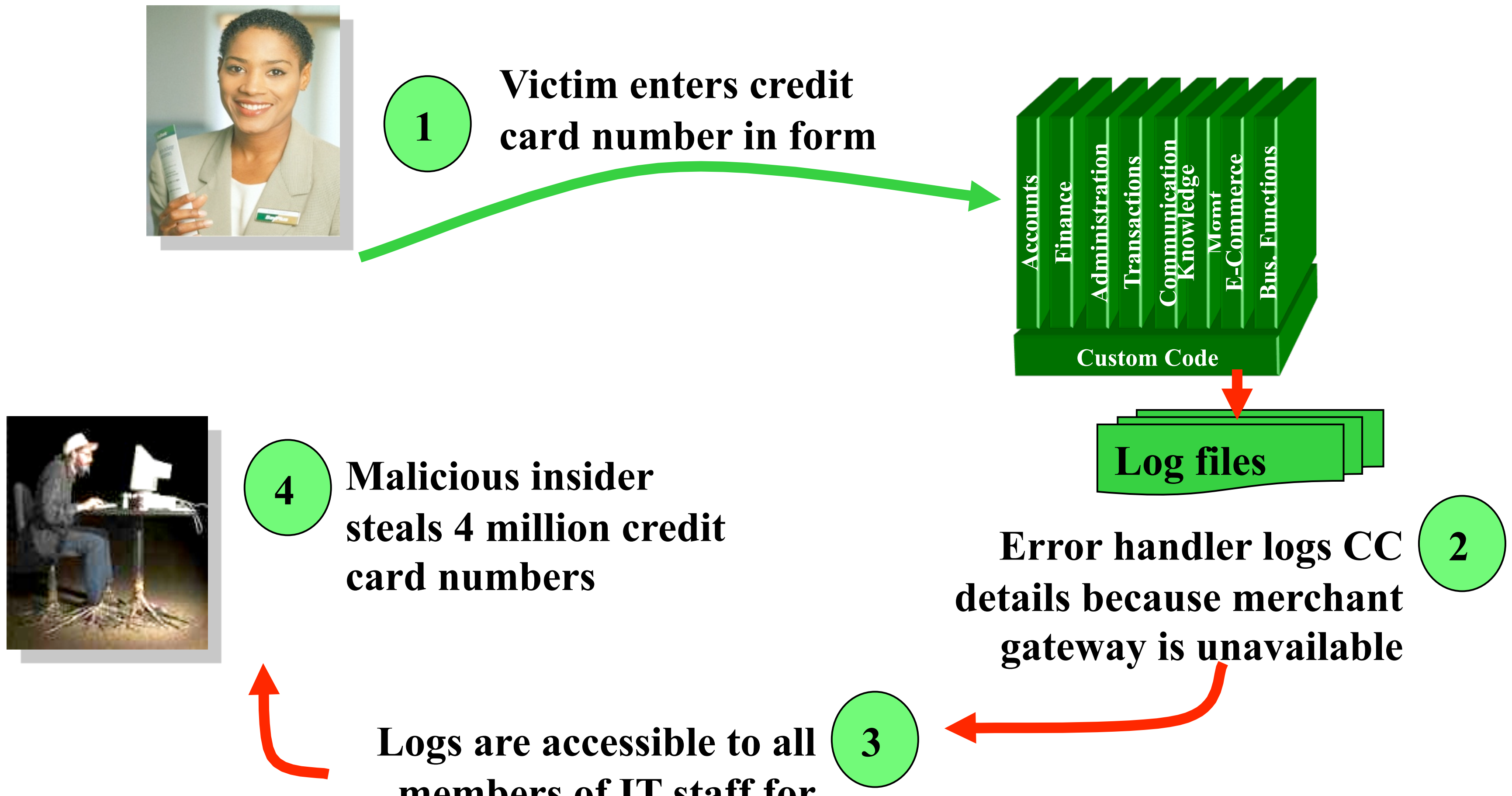
Storing sensitive data insecurely

- Failure to identify all sensitive data
- Failure to identify all the places that this sensitive data gets stored
  - Databases, files, directories, log files, backups, etc.
- Failure to properly protect this data in every location

Typical Impact

- Attackers access or modify confidential or private information
  - e.g, credit cards, health care records, financial data (yours or your customers)
- Attackers extract secrets to use in additional attacks
- Company embarrassment, customer dissatisfaction, and loss of trust
- Expense of cleaning up the incident, such as forensics, sending apology letters, reissuing thousands of credit cards, providing identity theft insurance
- Business gets sued and/or fined

Insecure Cryptographic Storage Illustrated



1 Victim enters credit card number in form

2 Error handler logs CC details because merchant gateway is unavailable

3 Logs are accessible to all members of IT staff for debugging purposes

4 Malicious insider steals 4 million credit card numbers

A7 – Avoiding Insecure Cryptographic Storage

- Verify your architecture
  - Identify all sensitive data
  - Identify all the places that data is stored
  - Ensure threat model accounts for possible attacks
  - Use encryption to counter the threats, don't just 'encrypt' the data
- Protect with appropriate mechanisms
  - File encryption, database encryption, data element encryption
- Use the mechanisms correctly
  - Use standard strong algorithms
  - Generate, distribute, and protect keys properly
  - Be prepared for key change
- Verify the implementation
  - A standard strong algorithm is used, and it's the proper algorithm for this situation
  - All keys, certificates, and passwords are properly stored and protected
  - Safe key distribution and an effective plan for key change are in place
  - Analyze encryption code for common flaws

A8 – Failure to Restrict URL Access

How do you protect access to URLs (pages)?

- This is part of enforcing proper "authorization", along with A4 – Insecure Direct Object References

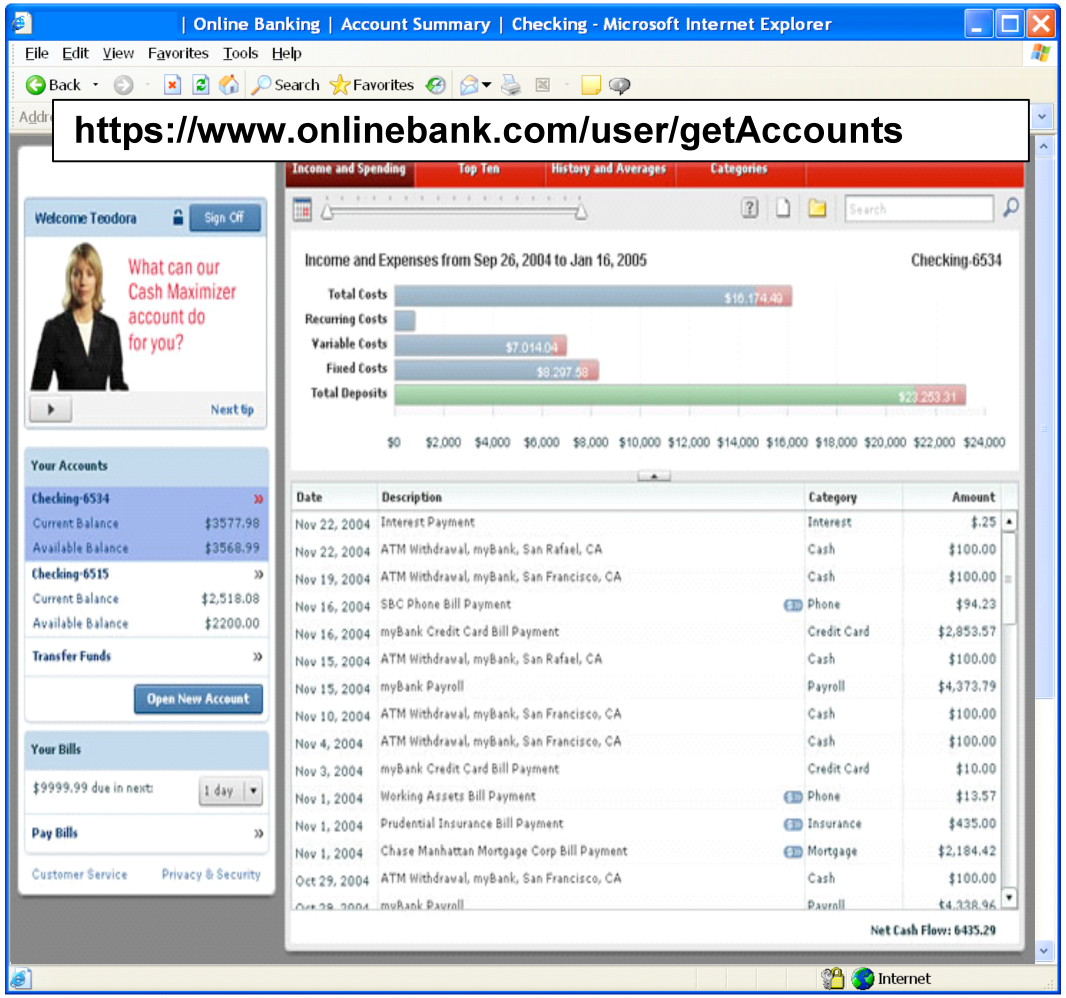
A common mistake …

- Displaying only authorized links and menu choices
- This is called presentation layer access control, and doesn't work
- Attacker simply forges direct access to 'unauthorized' pages

Typical Impact

- Attackers invoke functions and services they're not authorized for
- Access other user's accounts and data
- Perform privileged actions

Failure to Restrict URL Access Illustrated


| Online Banking | Account Summary | Checking - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address
Income and Spending
Top Ten
History and Averages
Categories
Search
Welcome Teodora
Sign Off
What can our Cash Maximizer account do for you?
Next tip
Internet

https://www.onlinebank.com/user/getAccounts

Income and Expenses from Sep 26, 2004 to Jan 16, 2005 — Checking-6534

Total Costs	$16,174.49
Recurring Costs	
Variable Costs	$7,014.04
Fixed Costs	$9,207.58
Total Deposits	$23,253.31

$0 $2,000 $4,000 $6,000 $8,000 $10,000 $12,000 $14,000 $16,000 $18,000 $20,000 $22,000 $24,000

Your Accounts

Checking-6534	»
Current Balance	$3577.98
Available Balance	$3568.99
Checking-6515	»
Current Balance	$2,518.08
Available Balance	$2200.00
Transfer Funds	»

Open New Account

Your Bills

$9999.99 due in next: 1 day

Pay Bills »

Customer Service Privacy & Security

Date	Description	Category	Amount
Nov 22, 2004	Interest Payment	Interest	$.25
Nov 22, 2004	ATM Withdrawal, myBank, San Rafael, CA	Cash	$100.00
Nov 19, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Nov 16, 2004	SBC Phone Bill Payment	Phone	$94.23
Nov 16, 2004	myBank Credit Card Bill Payment	Credit Card	$2,853.57
Nov 15, 2004	ATM Withdrawal, myBank, San Rafael, CA	Cash	$100.00
Nov 15, 2004	myBank Payroll	Payroll	$4,373.79
Nov 10, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Nov 4, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Nov 3, 2004	myBank Credit Card Bill Payment	Credit Card	$10.00
Nov 1, 2004	Working Assets Bill Payment	Phone	$13.57
Nov 1, 2004	Prudential Insurance Bill Payment	Insurance	$435.00
Nov 1, 2004	Chase Manhattan Mortgage Corp Bill Payment	Mortgage	$2,184.42
Oct 29, 2004	ATM Withdrawal, myBank, San Francisco, CA	Cash	$100.00
Oct 29, 2004	myBank Payroll	Payroll	$4,338.96

Net Cash Flow: 6435.29

- Attacker notices the URL indicates his role

  /user/getAccounts

- He modifies it to another directory (role)

  /admin/getAccounts, or

  /manager/getAccounts

- Attacker views more accounts than just their own

A8 – Avoiding URL Access Control Flaws

- For each URL, a site needs to do 3 things
  - Restrict access to authenticated users (if not public)
  - Enforce any user or role based permissions (if private)
  - Completely disallow requests to unauthorized page types (e.g., config files, log files, source files, etc.)
- Verify your architecture
  - Use a simple, positive model at <u>every</u> layer
  - Be sure you actually have a mechanism at every layer
- Verify the implementation
  - Forget automated analysis approaches
  - Verify that each URL in your application is protected by either
    - An external filter, like Java EE web.xml or a commercial product
    - Or internal checks in YOUR code – Use ESAPI's isAuthorizedForURL() method
  - Verify the server configuration disallows requests to unauthorized file types
  - Use WebScarab or your browser to forge unauthorized requests

A9 – Insufficient Transport Layer Protection

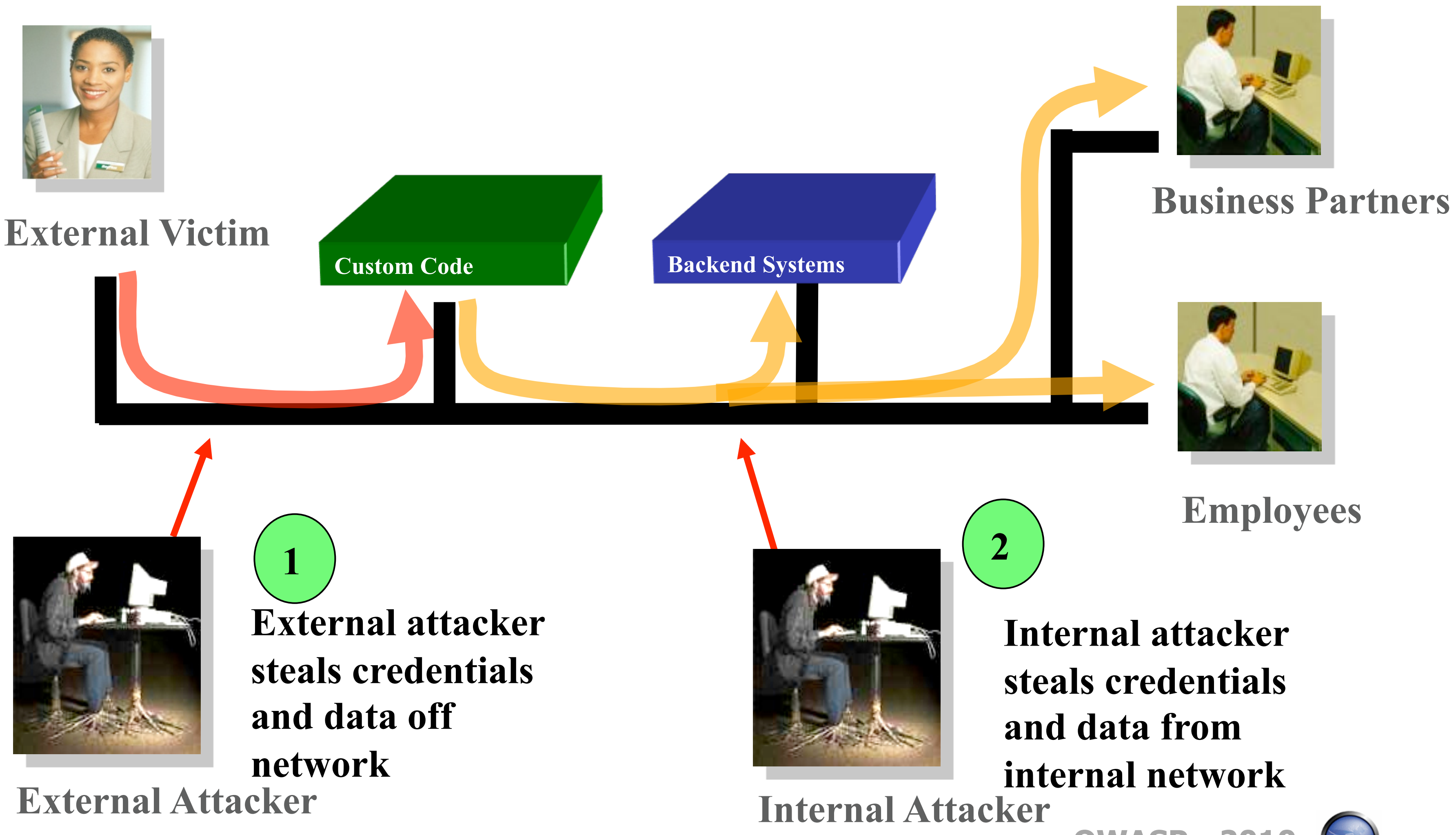
Transmitting sensitive data insecurely

- Failure to identify all sensitive data
- Failure to identify all the places that this sensitive data is sent
  - On the web, to backend databases, to business partners, internal communications
- Failure to properly protect this data in every location

Typical Impact

- Attackers access or modify confidential or private information
  - e.g, credit cards, health care records, financial data (yours or your customers)
- Attackers extract secrets to use in additional attacks
- Company embarrassment, customer dissatisfaction, and loss of trust
- Expense of cleaning up the incident
- Business gets sued and/or fined

Insufficient Transport Layer Protection Illustrated



External attacker steals credentials and data off network

Internal attacker steals credentials and data from internal network

A9 – Avoiding Insufficient Transport Layer Protection

- Protect with appropriate mechanisms
  - Use TLS on all connections with sensitive data
  - Individually encrypt messages before transmission
    - E.g., XML-Encryption
  - Sign messages before transmission
    - E.g., XML-Signature

- Use the mechanisms correctly
  - Use standard strong algorithms (disable old SSL algorithms)
  - Manage keys/certificates properly
  - Verify SSL certificates before using them
  - Use proven mechanisms when sufficient
    - E.g., SSL vs. XML-Encryption
- See: http://www.owasp.org/index.php/Transport_Layer_Protection_Cheat_Sheet for more details

A10 – Unvalidated Redirects and Forwards

Web application redirects are very common

- And frequently include user supplied parameters in the destination URL
- If they aren't validated, attacker can send victim to a site of their choice

Forwards (aka Transfer in .NET) are common too

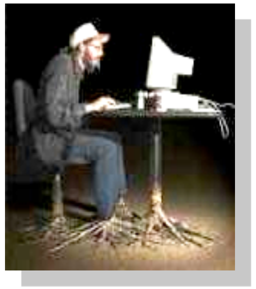
- They internally send the request to a new page in the same application
- Sometimes parameters define the target page
- If not validated, attacker may be able to use unvalidated forward to bypass authentication or authorization checks

Typical Impact

- Redirect victim to phishing or malware site
- Attacker's request is forwarded past security checks, allowing unauthorized function or data access

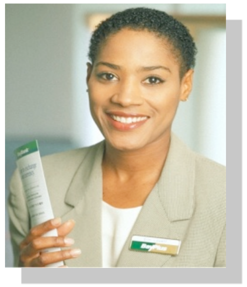
Unvalidated Redirect Illustrated

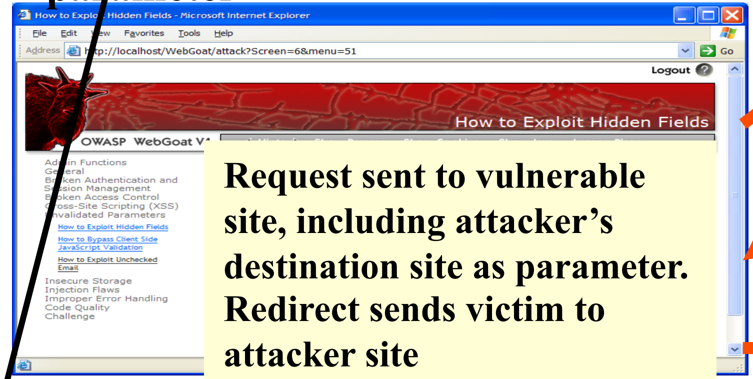
1 Attacker sends attack to victim via email or webpage



From: Internal Revenue Service
Subject: Your Unclaimed Tax Refund
Our records show you have an unclaimed federal tax refund. Please click here to initiate your claim.

2 Victim clicks link containing unvalidated parameter

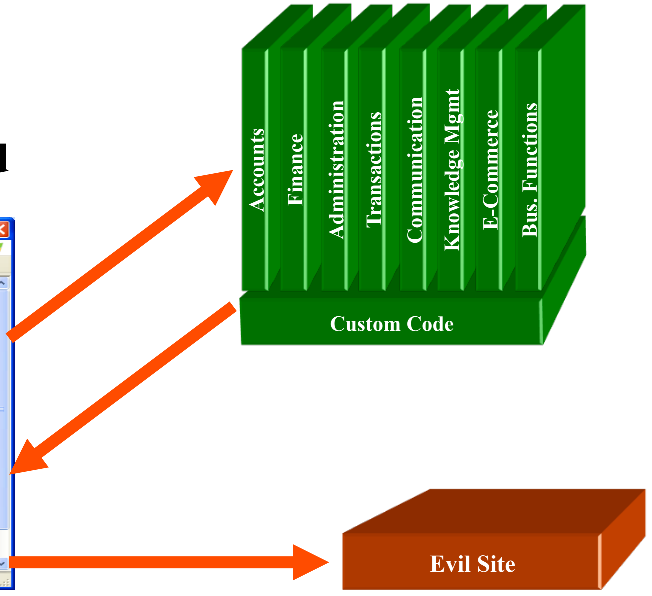



How to Exploit Hidden Fields - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/WebGoat/attack?Screen=6&menu=51
Go
Logout
How to Exploit Hidden Fields
OWASP WebGoat V
Admin Functions
General
Broken Authentication and Session Management
Broken Access Control
Cross-Site Scripting (XSS)
Unvalidated Parameters
How to Exploit Hidden Fields
How to Bypass Client Side JavaScript Validation
How to Exploit Unchecked Email
Insecure Storage
Injection Flaws
Improper Error Handling
Code Quality
Challenge

Request sent to vulnerable site, including attacker's destination site as parameter. Redirect sends victim to attacker site

http://www.irs.gov/taxrefund/claim.jsp?year=2006& … &dest=www.evilsite.com

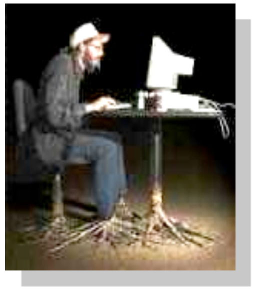
3 Application redirects victim to attacker's site

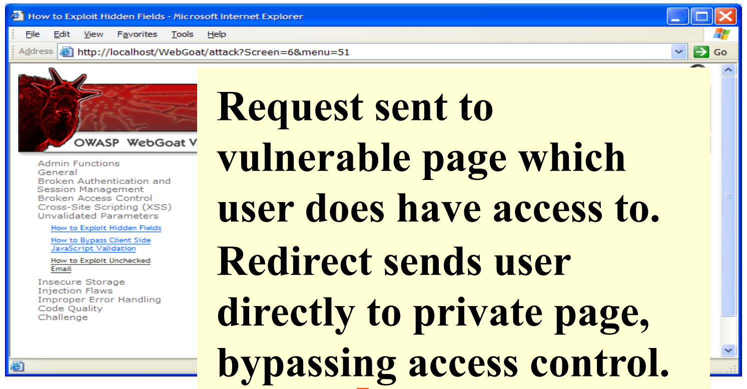


4 Evil site installs malware on victim, or phish's for private information

Unvalidated Forward Illustrated

1 Attacker sends attack to vulnerable page they have access to




How to Exploit Hidden Fields - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://localhost/WebGoat/attack?Screen=6&menu=51
OWASP WebGoat V
Admin Functions
General
Broken Authentication and Session Management
Broken Access Control
Cross-Site Scripting (XSS)
Unvalidated Parameters
How to Exploit Hidden Fields
How to Bypass Client Side JavaScript Validation
How to Exploit Unchecked Email
Insecure Storage
Injection Flaws
Improper Error Handling
Code Quality
Challenge

Request sent to vulnerable page which user does have access to. Redirect sends user directly to private page, bypassing access control.

```
public void
sensitiveMethod( HttpServletRequest
request, HttpServletResponse
response) {
    try {
            // Do sensitive stuff here.
            ...
    }
    catch ( ...
```

2 Application authorizes request, which continues to vulnerable page

Filter

```
public void doPost( HttpServletRequest request,
HttpServletResponse response) {
    try {
        String target = request.getParameter( "dest" ) );
        ...

        request.getRequestDispatcher( target ).forward(req
        uest, response);
    }
    catch ( ...
```

3 Forwarding page fails to validate parameter, sending attacker to unauthorized page, bypassing access control

A10 – Avoiding Unvalidated Redirects and Forwards

- There are a number of options
  1. Avoid using redirects and forwards as much as you can
  2. If used, don't involve user parameters in defining the target URL
  3. If you 'must' involve user parameters, then either
     a) Validate each parameter to ensure its valid and authorized for the current user, or
     b) (preferred) – Use server side mapping to translate choice provided to user with actual target page
  - Defense in depth: For redirects, validate the target URL after it is calculated to make sure it goes to an authorized external site
  - ESAPI can do this for you!!
    - See: SecurityWrapperResponse.sendRedirect(URL)
    - http://owasp-esapi-java.googlecode.com/svn/trunk_doc/org/owasp/esapi/filters/SecurityWrapperResponse.html#sendRedirect(java.lang.String)

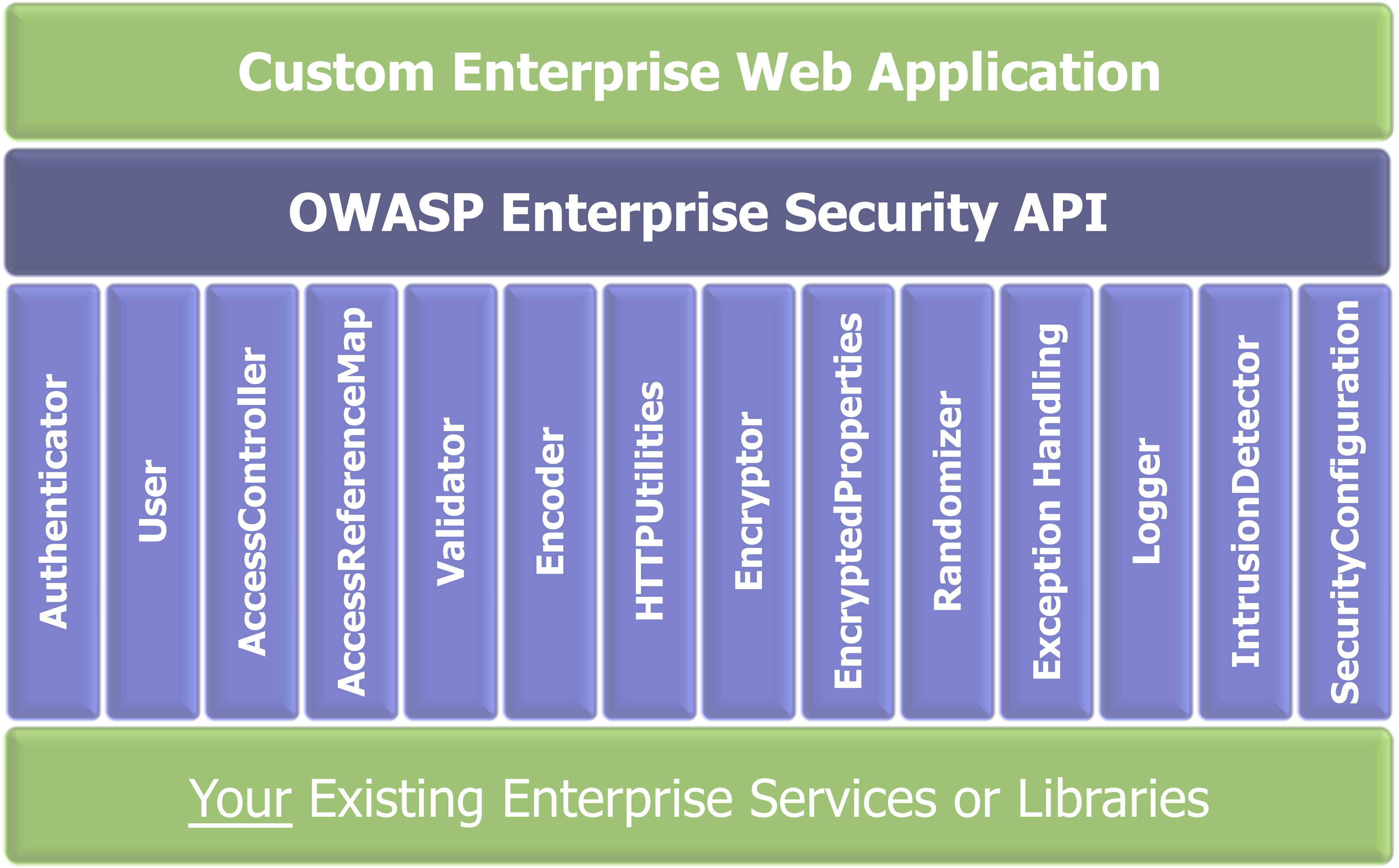
- Some thoughts about protecting Forwards
  - Ideally, you'd call the access controller to make sure the user is authorized before you perform the forward (with ESAPI, this is easy)
  - With an external filter, like Siteminder, this is not very practical
  - Next best is to make sure that users who can access the original page are ALL authorized to access the target page.

Summary: How do you address these problems?

- Develop Secure Code
  - Follow the best practices in OWASP's Guide to Building Secure Web Applications
    - http://www.owasp.org/index.php/Guide
  - Use OWASP's Application Security Verification Standard as a guide to what an application needs to be secure
    - http://www.owasp.org/index.php/ASVS
  - Use standard security components that are a fit for your organization
    - Use OWASP's ESAPI as a basis for <u>your</u> standard components
    - http://www.owasp.org/index.php/ESAPI

- Review Your Applications
  - Have an expert team review your applications
  - Review your applications yourselves following OWASP Guidelines
    - OWASP Code Review Guide: http://www.owasp.org/index.php/Code_Review_Guide
    - OWASP Testing Guide: http://www.owasp.org/index.php/Testing_Guide

OWASP (ESAPI)



ESAPI Homepage: http://www.owasp.org/index.php/ESAPI

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