OWASP and the OWASP Top 10 (2007 Update)

Sebastien Deleersnyder
OWASP BE Chapter Leader

OWASP

CISSP, CISA, CISM
AppSec consultant
seba@deleersnyder.eu

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

Agenda

- OWASP?
- OWASP Top 10, v2007RC1
- Belgium Chapter

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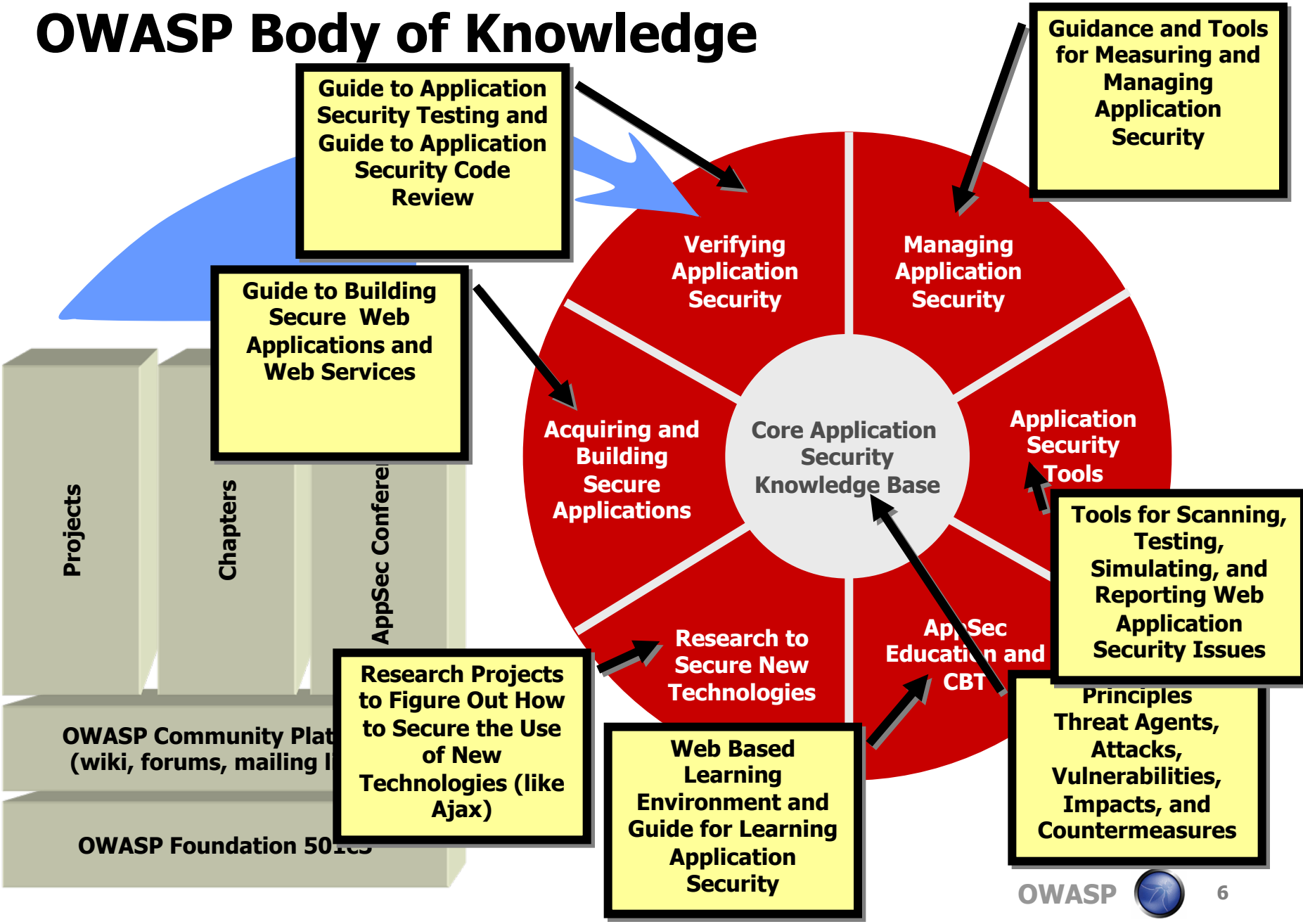
OWASP

- The Open Web Application Security Project (OWASP)
- International not-for-profit charitable Open Source organization funded primarily by volunteers time, OWASP Memberships, and OWASP Conference fees
- Participation in OWASP is free and open to all

OWASP Mission

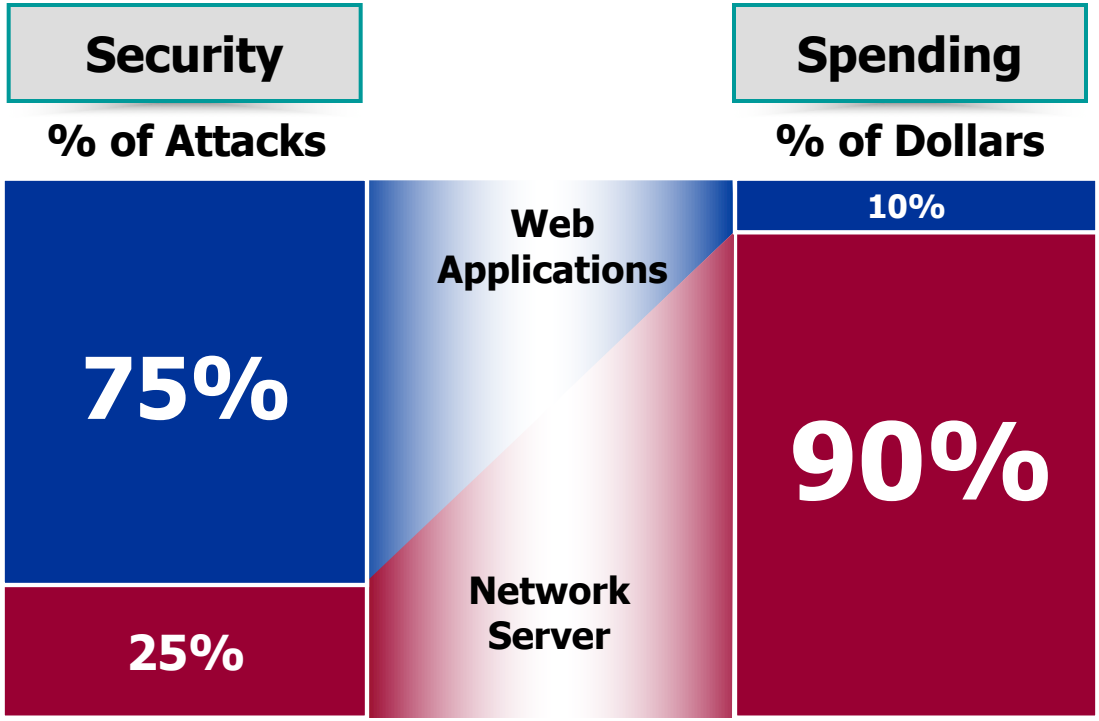
- To find and fight the causes of insecure software

OWASP Body of Knowledge



www.owasp.org (our wiki)

Why OWASP?
Attacks Shift Towards Application Layer

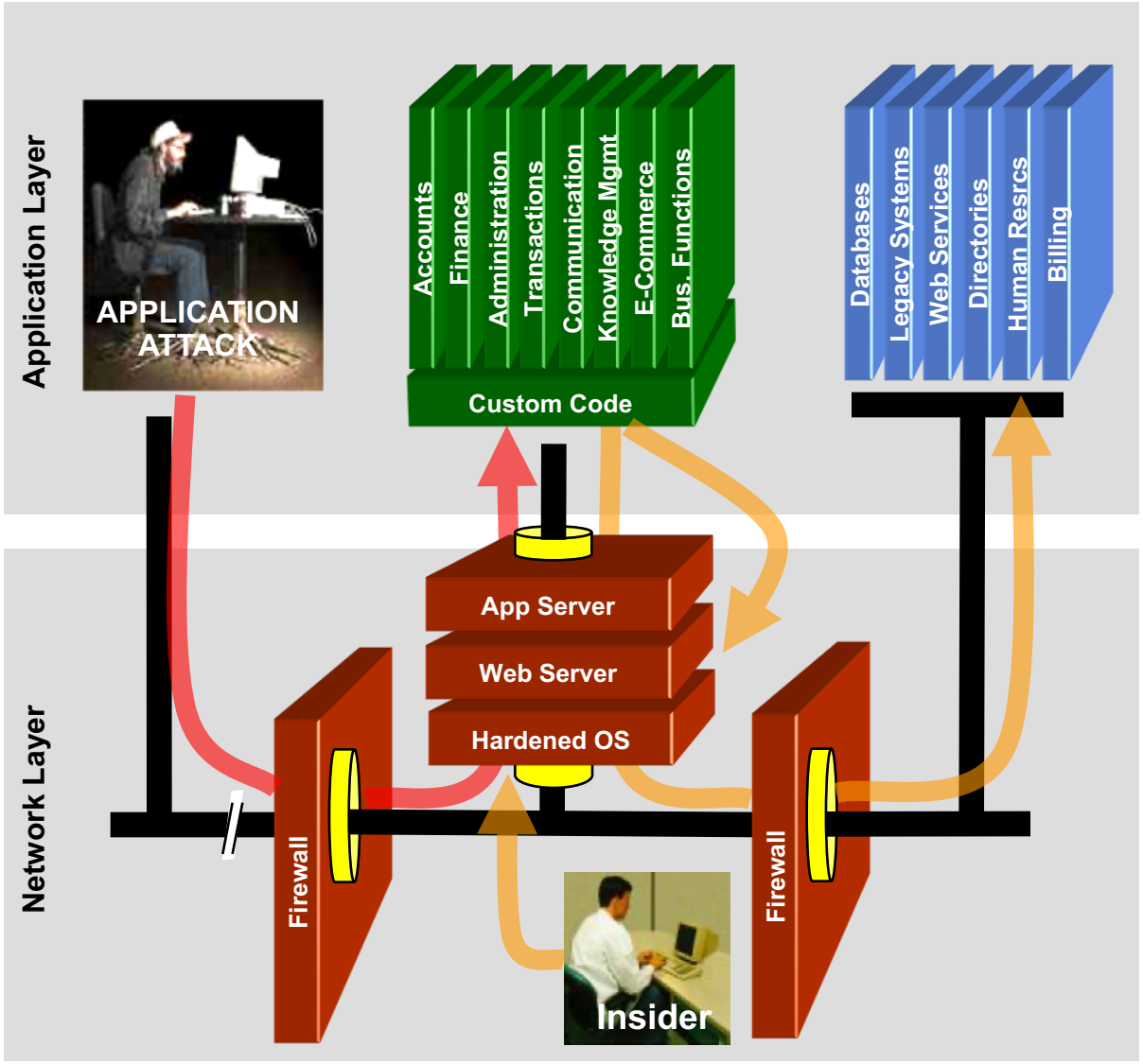


2/3 of All Web Applications Are Vulnerable

Gartner

Sources: Gartner, Watchfire

Problem Illustration



Application Layer

- Attacker sends attacks inside valid HTTP requests
- Your custom code is tricked into doing something it should not
- Security requires software development expertise, not signatures

Network Layer

- Firewall, hardening, patching, IDS, and SSL cannot detect or stop attacks inside HTTP requests.
- Security relies on signature databases

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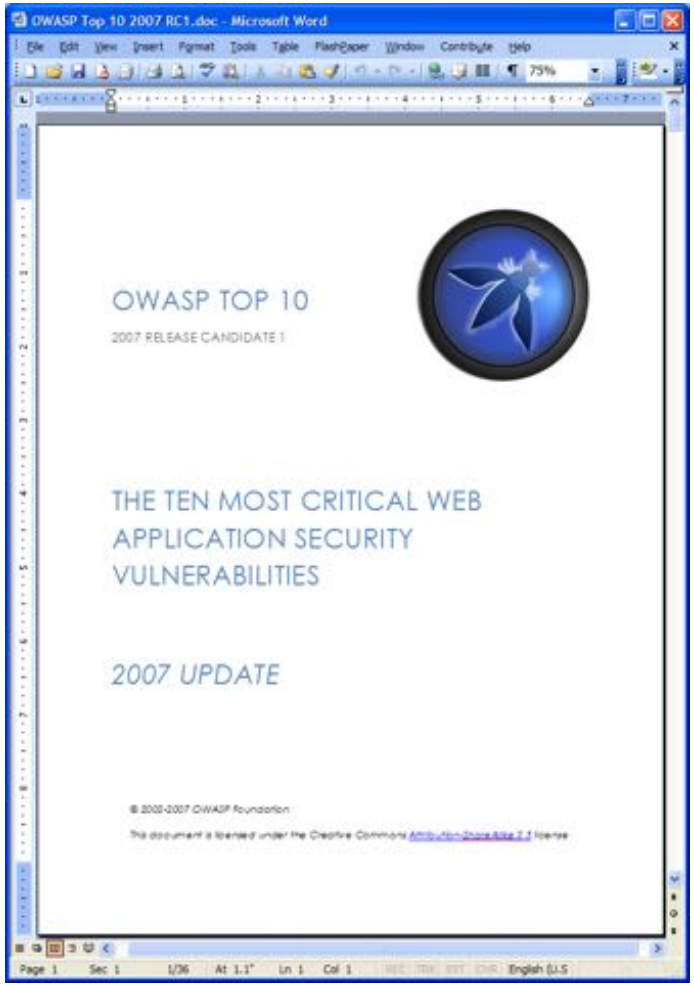
What is the OWASP Top 10?

- The first (but not only) things you should focus on …



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

OWASP Top Ten – 2007 Update

- **Release Candidate 1 – Undergoing internal review**
  - **Will be made public by March 2007 (RC2 next week)**

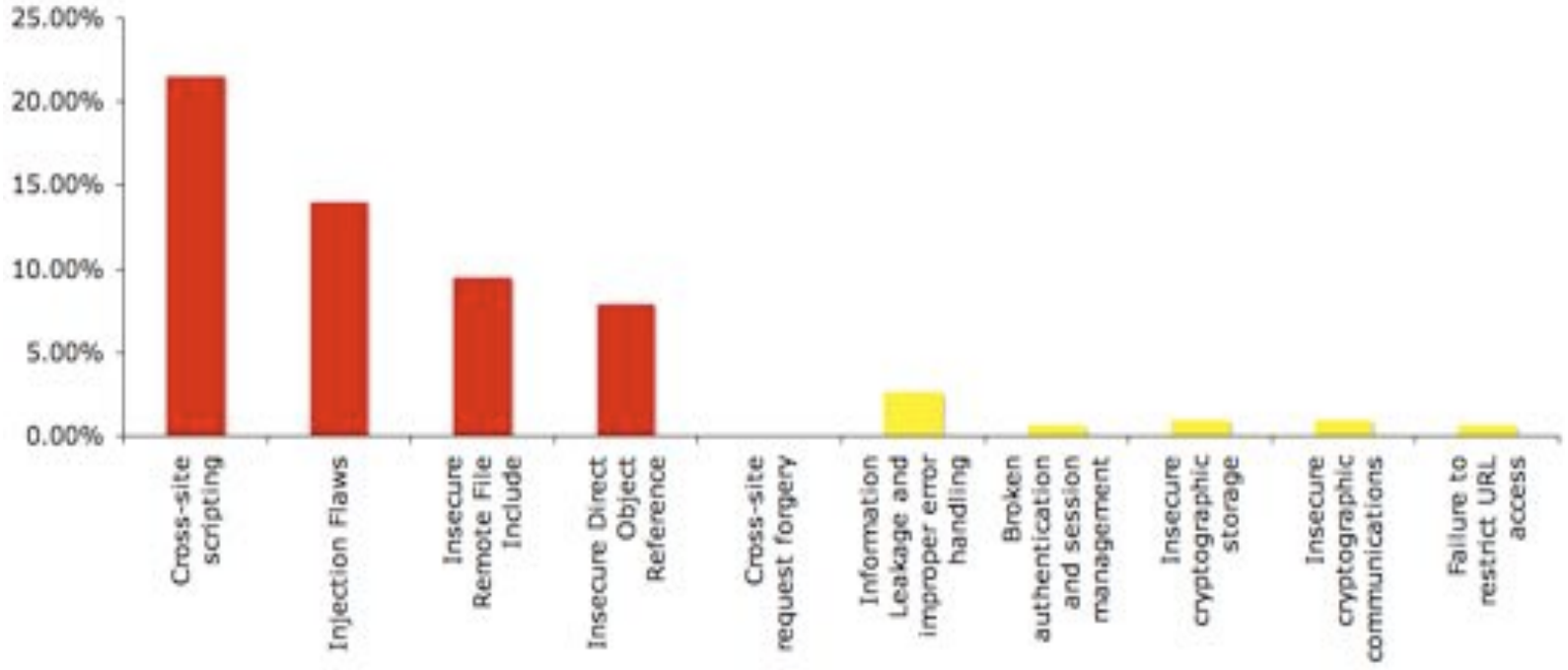
A1: Cross Site Scripting (XSS)
A2: Injection Flaws
A3: Malicious File Execution
A4: Insecure Direct Object Reference
A5: Cross Site Request Forgery (CSRF)
A6: Information Leakage and Improper Error Handling
A7: Broken Authentication and Session Management
A8: Insecure Cryptographic Storage
A9: Insecure Communications
A10: Failure to Restrict URL Access

RC1: http://www.owasp.org/index.php?title=Top_10_2007

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

Top 10 Methodology

- Take the MITRE Vulnerability Trends for 2006, and distill the Top 10 *web application security* issues



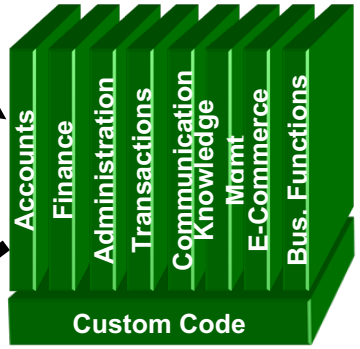
A1. Cross-Site Scripting (XSS)

- Occurs any time…
  - Raw data from attacker is sent to an innocent user
- Raw data…
  - Stored in database
  - Reflected from web input (form field, hidden field, url, etc…)
  - Sent directly into rich JavaScript client
- Virtually every web application has this problem
  - Try this in your browser – javascript:alert(document.cookie)

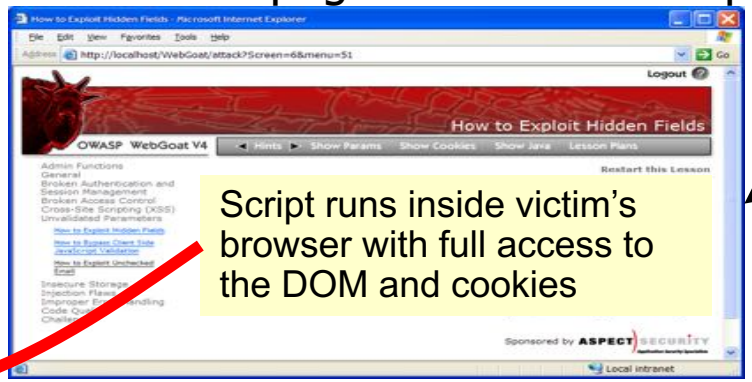
Cross-Site Scripting Illustrated

1 Attacker sets the trap – update my profile

Application with stored XSS vulnerability



2 Victim views page – sees attacker profile



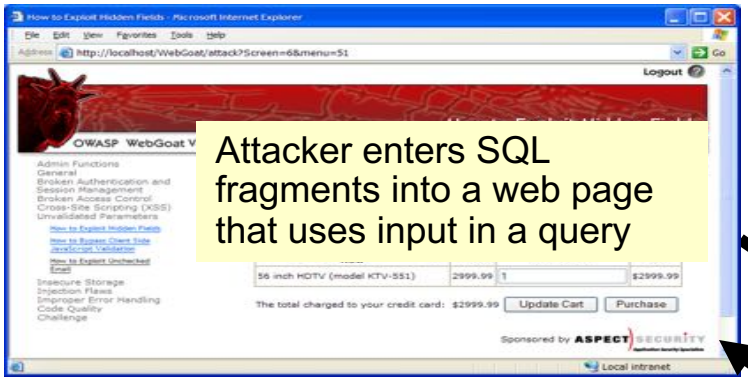
3 Script silently sends attacker Victim's session cookie

A2. Injection Flaws

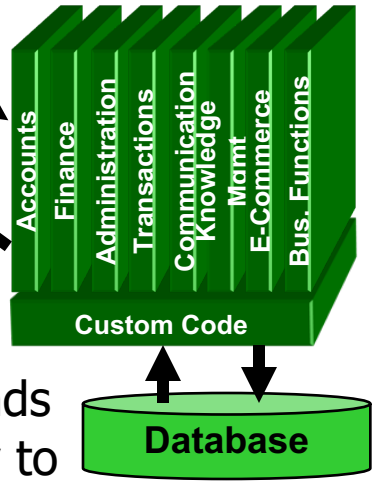
- Injection means…
  - Tricking an application into including unintended commands in the data sent to an interpreter
- Interpreters…
  - Take strings and interpret them as commands
  - SQL, OS Shell, LDAP, XPath, etc…
- SQL injection is still quite common
  - Many applications still susceptible

Example: SQL Injection Illustrated

1 Attacker sends data containing SQL fragments



3 Attacker views unauthorized data



2 Application sends modified query to database, which executes it

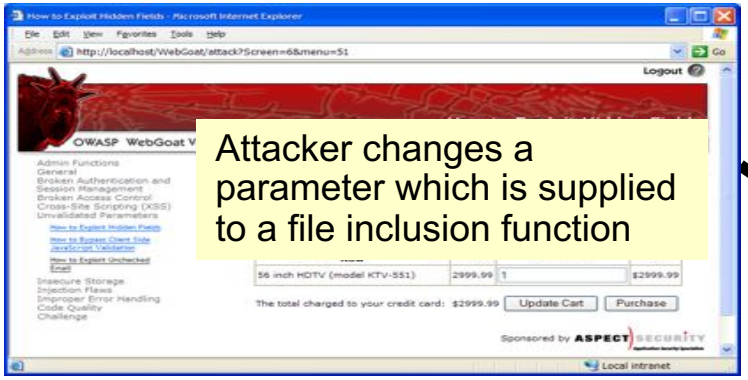
EXAMPLE:
$sql = "SELECT * FROM table WHERE id = '" . $_REQUEST['id'] . "'";

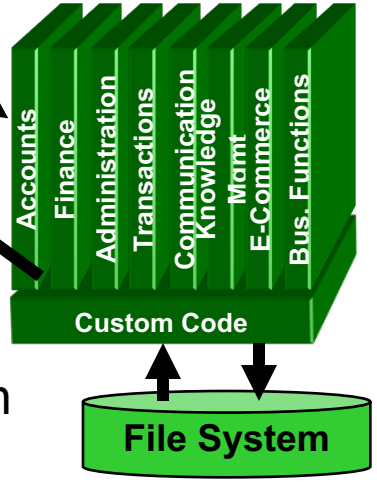
A3: Malicious File Execution

- Occurs when …
  - Attacker can influence an application to reference, upload, or create reference to a malicious file that gets executed
- Example Scenarios
  - Very frequent flaw in PHP applications where untrusted variables are used in calls like include(), include_once(), require(), etc.
  - Application accepts name of file to execute as input, such as language choice drop down menus
  - Attacker supplies unauthorized reference to code (usually an attack script)
- Can occur in any framework, not just PHP: XSLT transforms, batch file includes, log files, etc.

Example: PHP Remote File Include Illustrated

1 Attacker sends request that specifies the path to a malicious file in a parameter





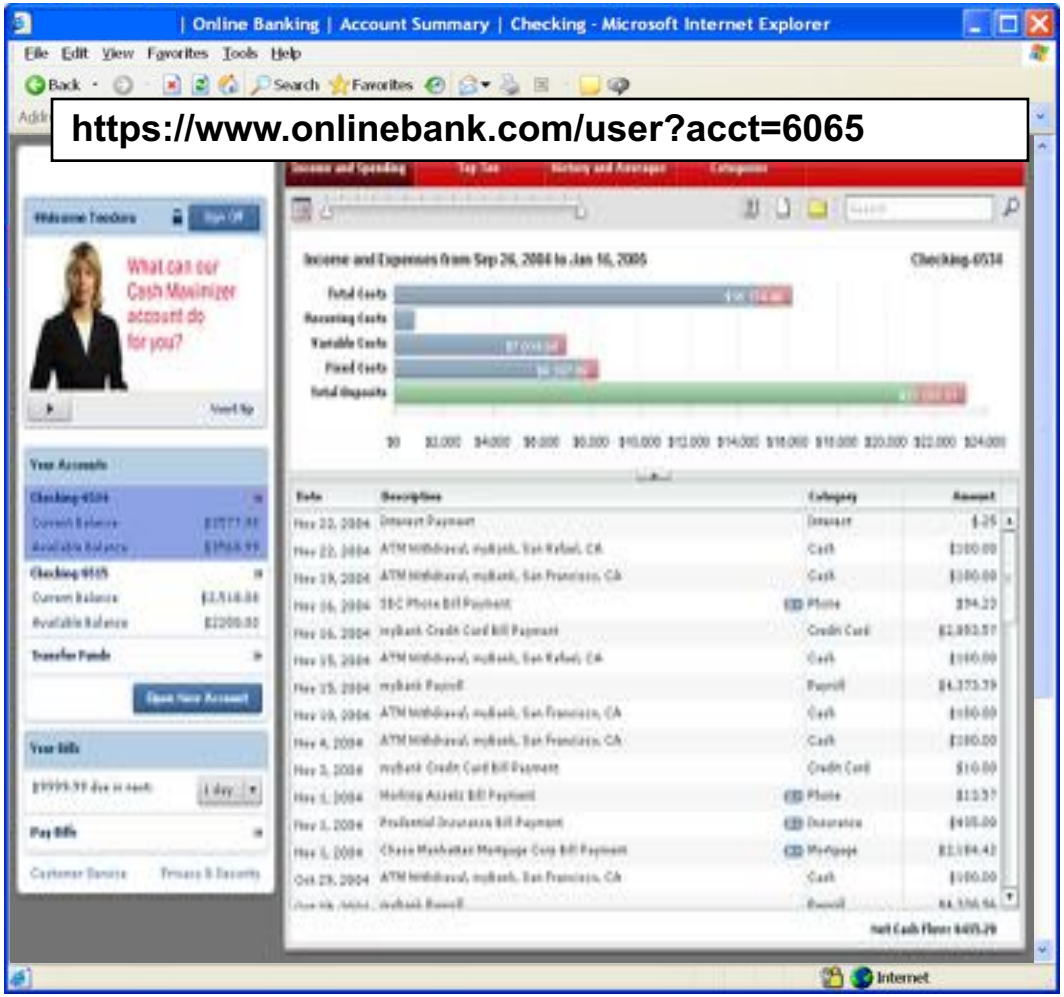
3 Attacker views results of executing the attack, or takes control of the affected server

2 PHP application includes the specified file and executes the contents

A4. Insecure Direct Object Reference

- How do you protect access to data and other objects?
  - This is part of enforcing proper "authorization", along with A10: Failure to Restrict URL Access
- Frequently enforced by
  - Only listing the 'authorized' objects for the current user
  - Hiding the object references in hidden fields
  - This is called presentation layer access control, and doesn't work
  - Attacker simply tampers with parameter value
- For each parameter, a site needs to do 3 things
  - Verify the parameter is properly formatted
  - Verify the user is allowed to access the target object
  - Verify the requested mode of access is allowed to the target object (e.g., read, write, delete)

Insecure Direct Object Reference Illustrated



- 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

A5. Cross Site Request Forgery

- Cross Site Request Forgery (CSRF)
  - An attack where the victim's browser is tricked into issuing a command to a vulnerable web application
- 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?
- Attackers can use CSRF to…
  - Initiate transactions (transfer funds, logout user, close account, etc…)
  - Access sensitive data
  - Change account details
  - And much more…

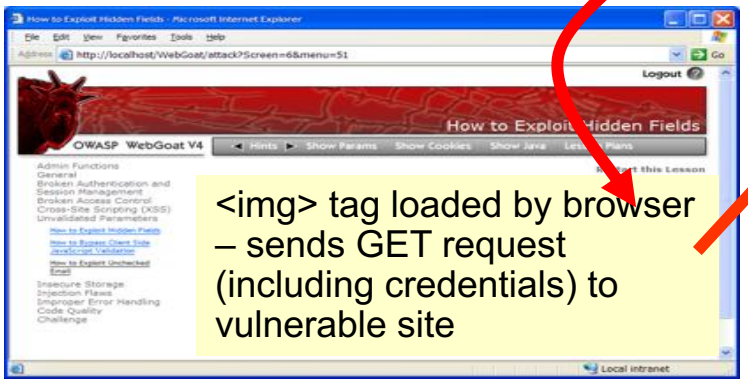
CSRF Illustrated

1

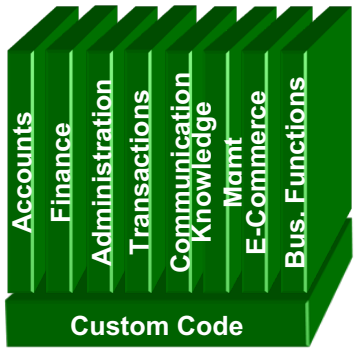
Attacker sets the trap on some website on the internet (or simply via an e-mail)

2

While logged into vulnerable site, victim views attacker site



Application with CSRF vulnerability



3

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

A6. Information Leakage and Improper Error Handling

- Web applications leak information and encounter error conditions
  - Frequently this invokes untested code paths
  - Attackers learn about your application through error messages
- Identify attacks and handle appropriately
  - Never show a user a stack trace
  - If someone is attacking you, don't keep trying to help
  - But how do you know which errors are attacks?
- Most web applications are quite fragile
  - Especially when you use a tool like WebScarab

Improper Error Handling Illustrated

- Many security mechanisms fail open
  - isAuthenticated()
  - isAuthorized()
  - isValid()

- Bad logic (i.e., fail open)

```
if (!security_test())
    then return false
return true
```

- Good logic (i.e., fail secure)

```
if (security_test())
    then return true
return false
```


Server Error in '/project' Application.

Syntax error (missing operator) in query expression "Constantly harrassing coworkers<script>alert('DE')</script>".

Description: An unhandled exception occurred during the execution of the current web request. Please review the stack trace for more information about the error and where it orig

Exception Details: System.Data.OleDb.OleDbException: Syntax error (missing operator) in query expression "Constantly harrassing coworkers<script>alert('DE')</script>".

Source Error:

```
Line 131:                OleDbCommand com = new OleDbCommand(sql, con);
Line 132:
Line 133:                int i = com.ExecuteNonQuery();
Line 134:            }
Line 135:        } catch (FormatException fe) {
```

Source File: c:\perforce_data\depot\WebGoat\DotNet\CSharpDotNet\main\project5CrossSiteScripting\EditProfile.aspx.cs **Line:** 133

Stack Trace:

```
[OleDbException (0x80040e14): Syntax error (missing operator) in query expression ''Constantly harrassing cowor
   System.Data.OleDb.OleDbCommand.ExecuteCommandTextForSingleResult(tagDBPARAMS dbParams, Object& executeResult
   System.Data.OleDb.OleDbCommand.ExecuteCommandText(Object& executeResult) -194
   System.Data.OleDb.OleDbCommand.ExecuteCommand(CommandBehavior behavior, Object& executeResult) +56
```

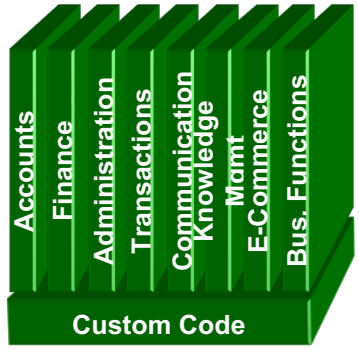
[Microsoft][ODBC Microsoft Access Driver] Syntax error in string in query expression 'last_name = 'bob' or foo''.

A7. Broken Authentication and Session Mgmt

- HTTP is "stateless" protocol
  - Means credentials have to go with every request
  - Should use SSL for everything requiring authentication
- Session management
  - SESSIONID used to track state since HTTP doesn't
  - SESSIONID is just as good as credentials to an attacker
  - Never expose SESSIONID on network, in browser, in logs, …
- Beware the side-doors
  - Change my password, remember my password, forgot my password, secret question, logout, email address, etc…

Broken Authentication Illustrated

1 User sends credentials



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

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

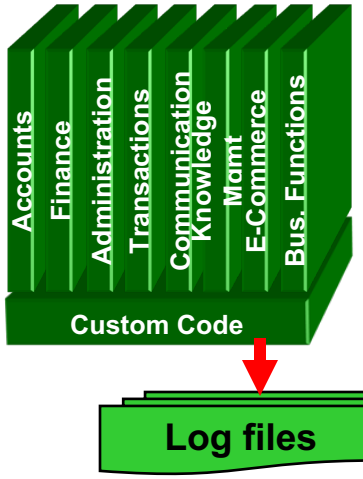
5 Hacker uses JSESSIONID and takes over victim's account

A8. Insecure Cryptographic Storage

- Storing sensitive data insecurely
  - Identify all sensitive data
  - Identify all the places that sensitive data is stored
    - Databases, files, directories, log files, backups, etc.
- Protect with appropriate mechanisms
  - File encryption, database encryption, data element encryption
- Use the mechanisms correctly
  - Use standard strong algorithms
  - Generate and protect keys
  - Be prepared for key change

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

A9. Insecure Communications

- Transmitting sensitive data insecurely
  - Identify all sensitive data
  - Identify all the places where sensitive data is sent
    - On the web, backend databases, business partners, internally
- Protect with appropriate mechanisms
  - Use SSL on all connections with sensitive data
  - Individually encrypt messages before transmission
- Use the mechanisms correctly
  - Use standard strong algorithms (disable old SSL alg.)
  - Manage keys/certificates properly
  - Use proven mechanisms when sufficient
    - E.g., SSL vs. XML-Encryption

Insecure Communications Illustrated

External Victim

Business Partners

Employees

External Attacker

1

External attacker steals credentials and data off network

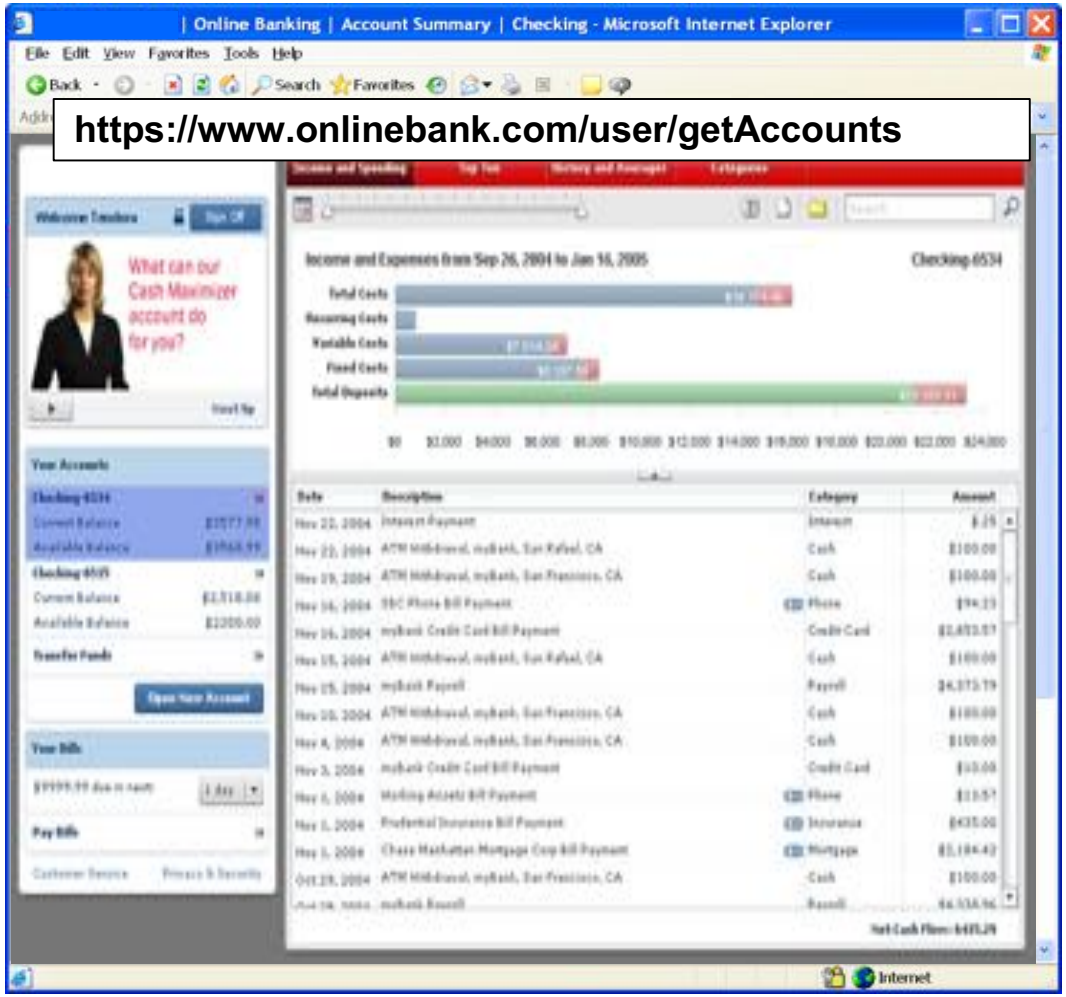
2

Internal attacker steals credentials and data from internal network

A10. Failure to Restrict URL Access

- How do you protect access to URLs (pages)?
  - This is part of enforcing proper "authorization", along with A4: securing direct object references
- Frequently enforced by
  - 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
- 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.)

Failure to Restrict URL Access Illustrated



- 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

Agenda

- OWASP?
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Belgium Chapter - What do we have to offer?

- Quarterly Meetings
- Local Mailing List
- Presentations & Groups
- Open forum for discussion
- Meet fellow InfoSec professionals
- Create (Web)AppSec awareness in Belgium
- Local projects: E.g. Education Project

OWASP near you soon:

- Next BE Chapter Meeting:
  - Tuesday May 10 2007 – (Leuven)
    - Legal Aspects (Web)AppSec (Jos Dumortier – Lawfort)
    - AppSec Research Topics (Lieven Desmet – KUL)
- Next EU conference: OWASP EU Italy
  - May 15th-17th - in Milan, Italy

Stay up to date

WWW.OWASP.ORG

Belgium:

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

contact: seba@deleersnyder.eu

Backup slides

Top 10 Mapping

OWASP Top 10 2007	OWASP Top 10 2004	MITRE 2006 Raw Ranking
1. Cross Site Scripting (XSS)	4. Cross Site Scripting (XSS)	1
2. Injection Flaws	6. Injection Flaws	2
3. Insecure Remote File Include (NEW)		3
4. Insecure Direct Object Reference	2. Broken Access Control (split in 2007 T10)	5
5. Cross Site Request Forgery (CSRF) (NEW)		36
6. Info Leakage and Improper Error Handling	7. Improper Error Handling	6
7. Broken Auth. and Session Management	3. Broken Authentication and Session Management	14
8. Insecure Cryptographic Storage	8. Insecure Storage	8
9. Insecure Communications (NEW)	Discussed under 10	8
10. Failure to Restrict URL Access	2. Broken Access Control (split in 2007 T10)	14
	1. Unvalidated Input	7
	5. Buffer Overflows	4, 8, and 10
	9. Denial of Service	17
	10. Insecure Configuration Management	29