JPL OCIO Information Technology

Creating Stronger, Safer, Web Facing Code

JPL IT Security
Mary Rivera
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Agenda

- Evolving Threats
  - Operating System
  - Application
  - User Generated Content
- JPL's Application Security Program
- Securing Web applications
  - Common vulnerabilities
  - Prevention techniques
  - Security testing tools
- Summary

10 Years ago…

- Operating System Attacks
  - Direct attacks
  - Buffer Overflow
  - Denial of Service
- Mitigation
  - System administrators got quicker at patch management
  - Vendors started releasing fixes quicker
  - Firewalls had better protection

3 years ago…

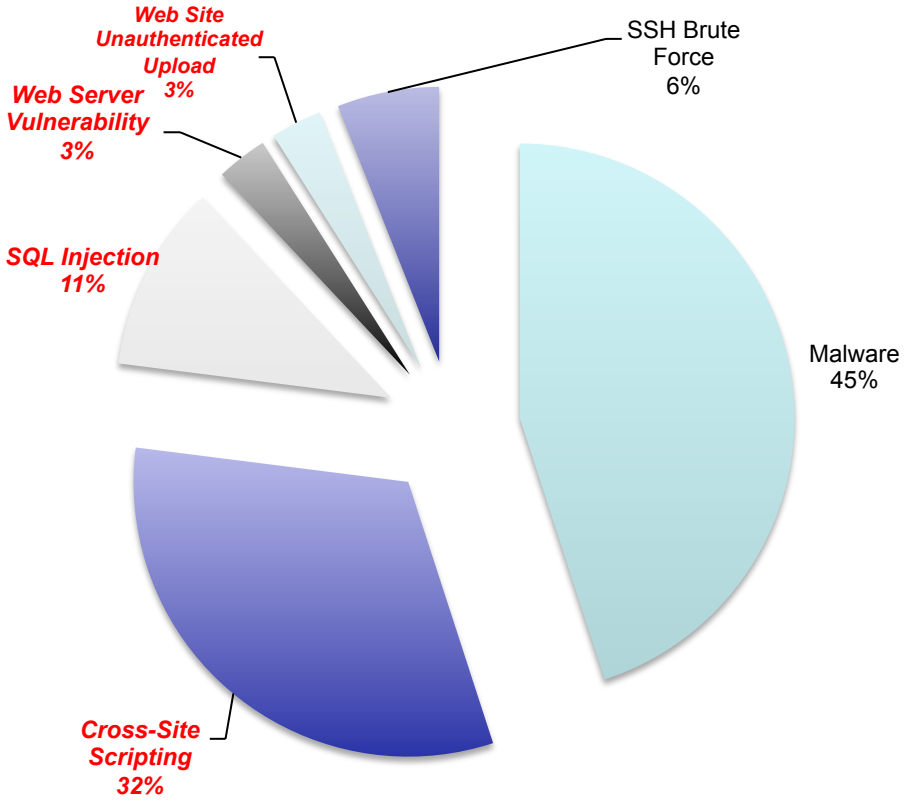
- Application Threats
  - Hackers moved up a level from OS to Application
  - Directed attacks against
    - SSH
    - Apache web servers
    - SQL database servers
- Mitigation
  - SA's got quicker at patch management
  - Vendors started releasing fixes quicker
  - Firewalls had better protection
  - IT Sec started scanning applications not just operating systems

Today…

- User Content Threats
  - Hackers moved up one more level from application itself to content within the application
  - Attacking User Content
  - User generated code
    - SQL injection, Cross Site Scripting
  - Neither SA's nor vendors know how to fix user code
- Mitigation
  - Help user become security aware
  - Security in the Lifecycle
  - Scan code

Half of the Security Incidents involved Applications

- Problem:
  - In 2008, 49% of the JPL security incidents involved application vulnerabilities (shown in *red*).



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JPL's Application Security Program

- App Security Registry
- Scanning Tools
- Security in Lifecycle
- Training & Awareness
- Security Guidelines

JPL Application Security Program

- Security Guidelines
  - Programming languages
    - PERL, ColdFusion, Java
  - Security checklists
- Training & Awareness
  - Developer training courses
    - Web Application Security
    - Online AppSec Training tutorials
  - Quarterly Application Security Newsletter

Application Security Program

- Security in Lifecycle
  - IT Security checklist
  - Security process
- Security Scanning tools
  - AppScan
    - Web application testing
    - Static source code analysis

Application Security Program

- Application Security Registry
  - Inventory of applications
  - Technical information about applications for security purposes
  - Identifies responsible personnel for each application in the inventory

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Common Web Vulnerabilities

- Open Web Application Security Project (OWASP) Top 10 list
  - Identifies the most common vulnerabilities
- Top Vulnerability categories
  - Injection flaws
  - Cross site scripting flaws

Injection Flaws

- Allows attackers to execute malicious code through a web application or other system
  - Access to OS via shell commands
  - Access to backend Database through SQL
    - SQL Injection

Injection Flaws

- SQL Injection
  - Application receives input from a user
  - Input is sent as part of a database query
  - Allows malicious users to execute commands on the database

  - Occurs due to:
    - Improper input validation
    - Over privileged database logins

Potential Effects of SQL Injection

- Complete access to database
- Bypass authentication controls
- Potential command line access from database machine

SQL Injection Example

- Vulnerable Query:
  - SELECT user FROM Users where loginName = ‘ $User’ and LoginPassword = ‘ $Password’
- Injected Query:
  - Attacker Input: $Password = ‘ OR 1 = 1 --
  - SELECT user FROM Users where loginName = ‘ jsmith’ and LoginPassword = ‘Demo1234 ‘ OR 1 = 1 --

SQL Injection Example

SELECT true FROM users
WHERE username = ' jsmith ' AND password = ' Demo1234 '

Injected Query:

Attacker's extra input to password: 'OR 1 = 1 --

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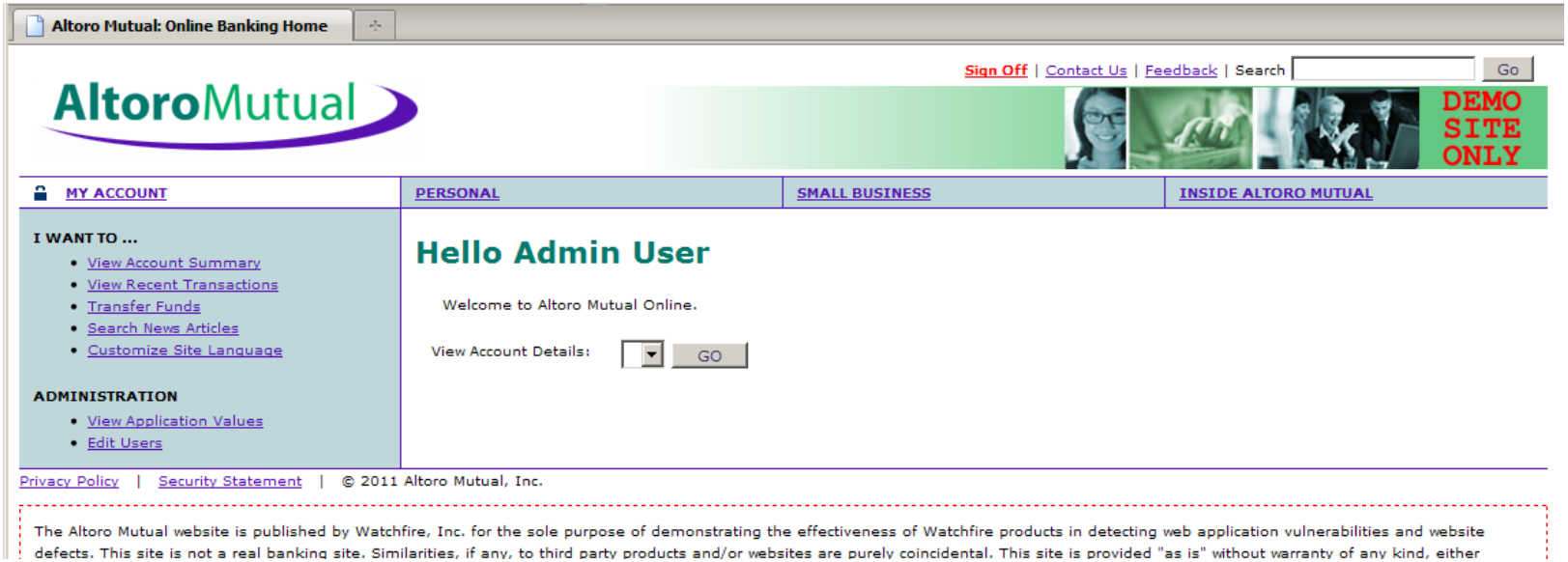
SQL Injection Example



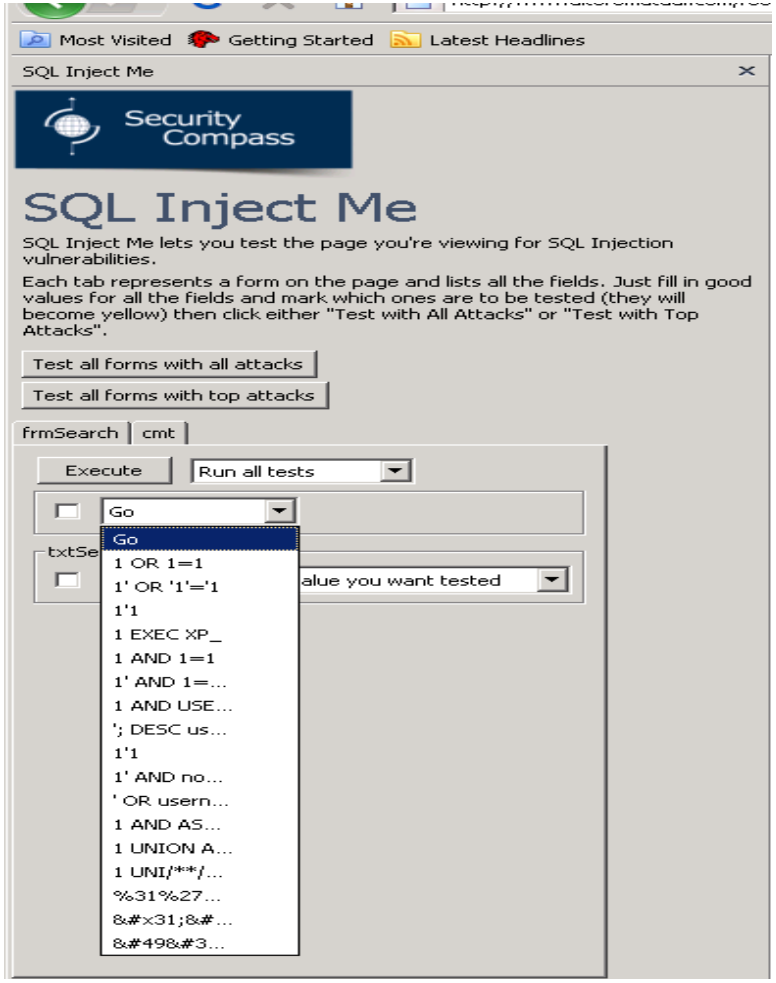
Application vulnerable to SQL injection

Preventing SQL Injection

- Use parameterized queries
- Use input validation
- Use low privileged accounts
- Limit error messages
- OWASP SQL Injection Prevention Cheat Sheet

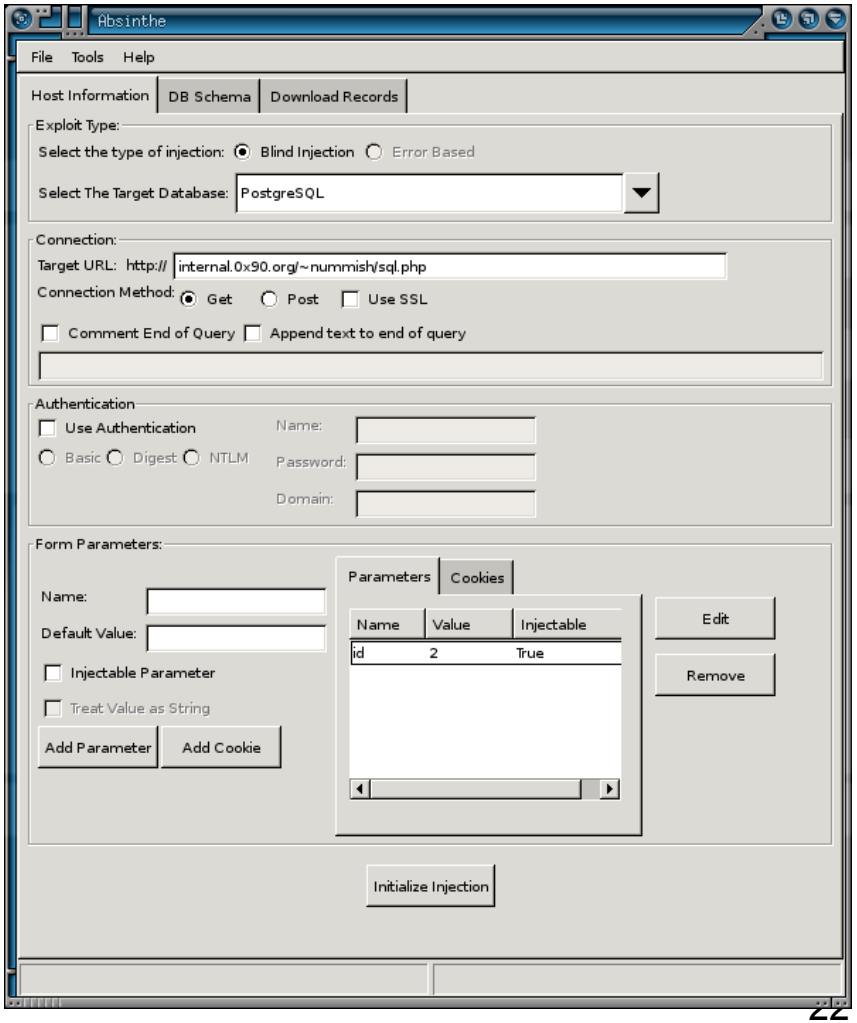
Testing Tools for SQL Injection

- SQL Inject Me
  - Firefox add on
- Other tools
  - Absinthe
  - Paros



Testing tool for SQL Injection

- Absinthe



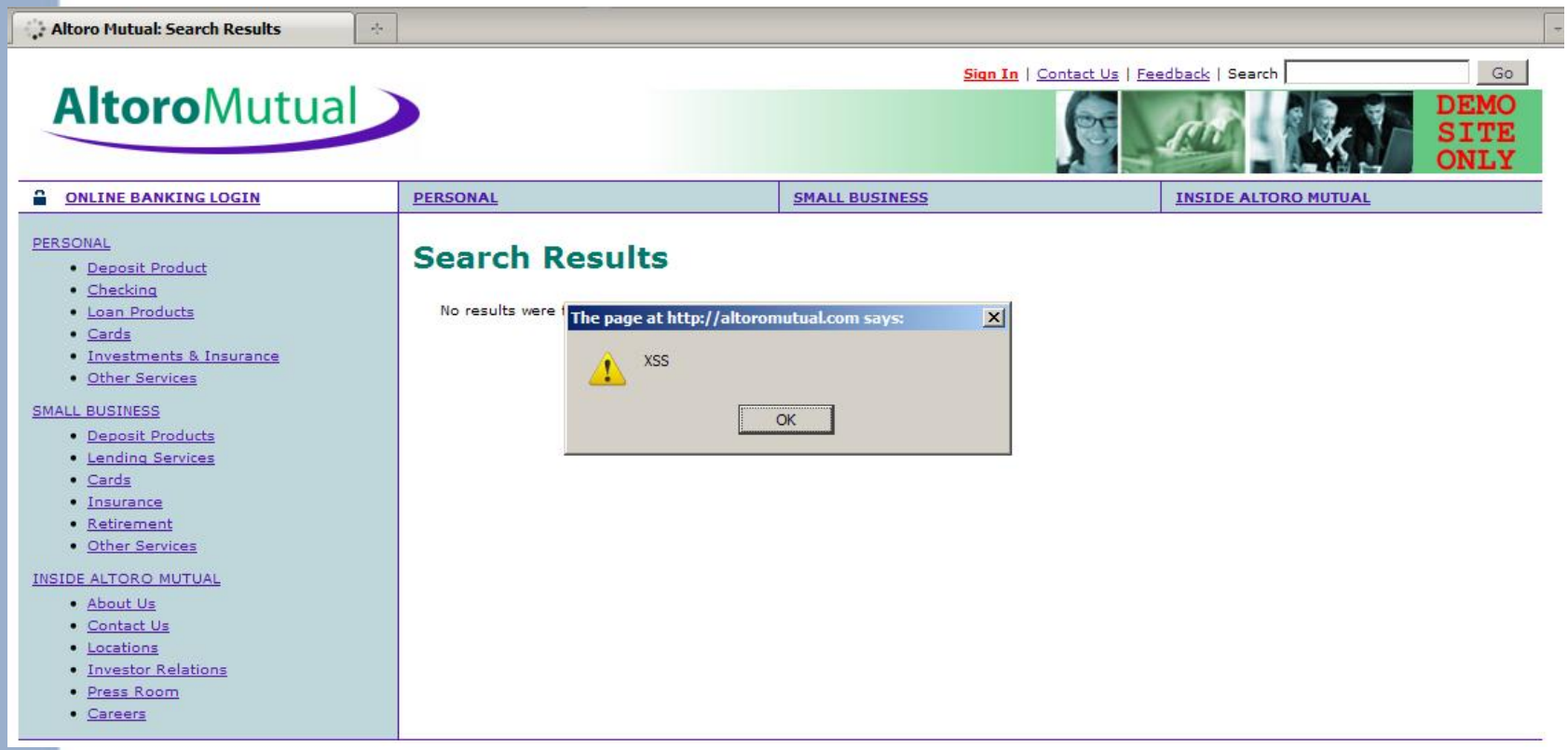
Cross-site scripting (XSS)

- Tricks the browser into executing code
  - JavaScript, VBScript, ActiveX, HTML, or Flash can be injected into a vulnerable application
- Application receives input from the user
- Input is returned back to the user without being sanitized

Potential Effects of XSS

- Redirection
- Web page contents modified
- Scripting commands
- Cookies compromised

XSS Example



Input String: <SCRIPT>alert(“XSS”)<SCRIPT>

Preventing XSS

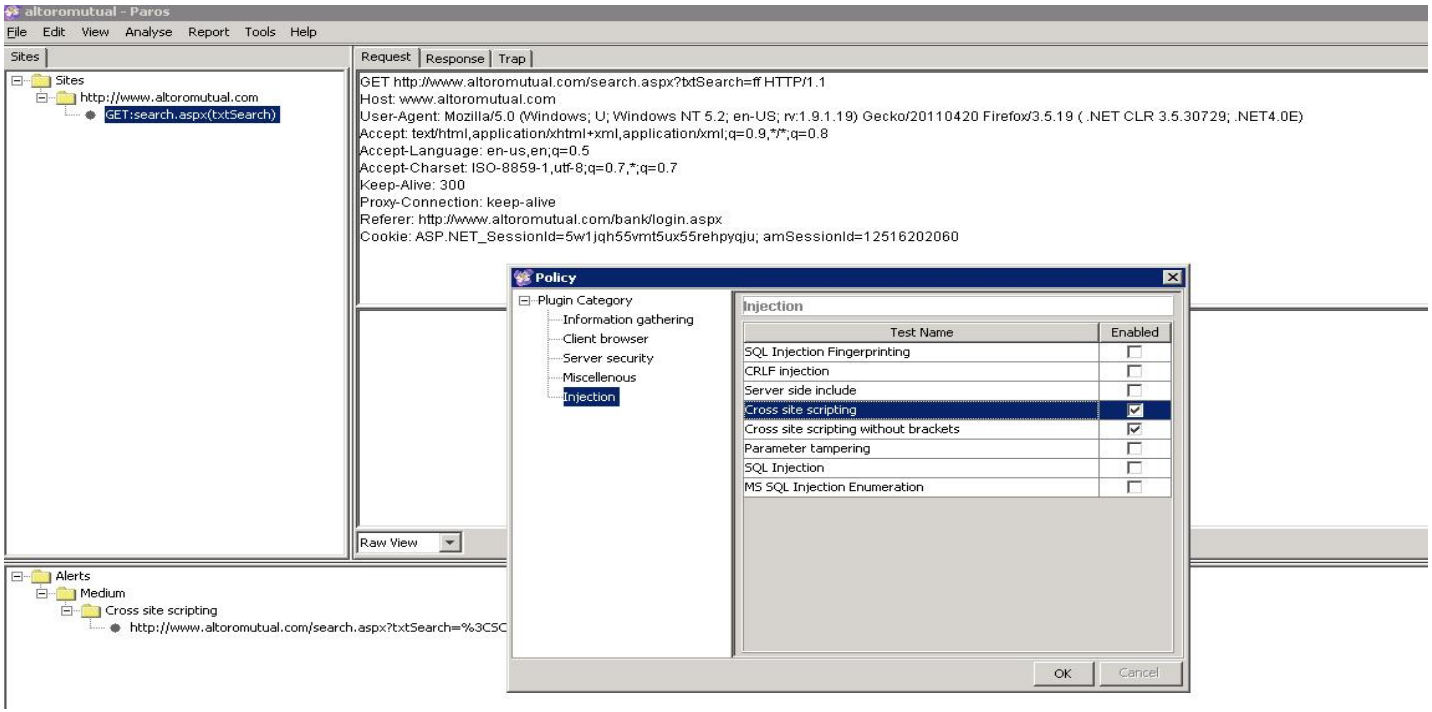
- Filter meta characters, scripting, object tags
  - <script> and <object>
- Use encoding

  - HTML encode or URL encode
- Detailed information on XSS prevention

  - OWASP XSS Prevention Cheat Sheet

Testing Tool for XSS

- Paros Proxy



Summary

- Changes in threats require keeping pace with changes
- Secure web applications by
  - Fixing common web vulnerabilities
  - Using prevention techniques
  - Using security testing tools

Resources

- Open Source Web Application Security Project (OWASP)
  - http://www.owasp.org
- SQL Injection Cheat Sheet

  https://www.owasp.org/index.php/SQL_Injection_Prevention_Cheat_Sheet
- XSS Cheat Sheet
  - https://www.owasp.org/index.php/XSS_%28Cross_Site_Scripting%29_Prevention_Cheat_Sheet
- Tools
  - Paros
    - http://www.parosproxy.org/download.shtml
  - SQL Injectme
    - https://addons.mozilla.org/en-US/firefox/addon/sql-inject-me/
  - Absinthe
    - http://www.0x90.org/releases/absinthe/

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QUESTIONS?