Java Web Application Security

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@mraible

Photos by **Trish** - http://mcginityphoto.com

Who is **Matt Raible**?

Father, Skier, Cyclist

Web Framework Connoisseur

Founder of AppFuse

Blogger on raibledesigns.com

Why am I here?

- **Purpose**
  - To learn more about Java webapp security and transform myself into a security expert.
- **Goals**
  - Show how to implement Java webapp security.
  - Show how to penetrate a Java webapp.
  - Show how to fix vulnerabilities.

Why are you here?

- For the free beer?
- Because you *care* about security?
- Have you used Java EE 6, Spring Security or Apache Shiro?
- What do you want to get from this talk?

Session Agenda

- Security Development
  - Java EE 6, Spring Security, Apache Shiro
  - SSL and Testing
- Verifying Security
  - OWASP Top 10 & Zed Attack Proxy
- Commercial Tools and Services
- Conclusion

Develop Penetrate Protect Relax

Develop

Dynamic Language Support?

- If it deploys on Tomcat, it has a web.xml
  - Grails
  - JRuby on Rails
  - Lift
  - Play! Framework

Java EE 6

- Security constraints defined in web.xml
  - web resource collection - URLs and methods
  - authorization constraints - role names
  - user data constraint - HTTP or HTTPS
- User Realm defined by App Server
- Declarative or *Programmatic* Authentication
- Annotations Support

Java EE 6 Demo

http://www.youtube.com/watch?v=8bXBGU7uo4o

Servlet 3.0

- HttpServletRequest
  - authenticate(response)
  - login(user, pass)
  - logout()
  - getRemoteUser()
  - isUserInRole(name)

Servlet 3.0 and JSR 250

- Annotations
  - @ServletSecurity
  - @HttpMethodConstraint
  - @HttpConstraint
  - @RolesAllowed
  - @PermitAll
  - @DenyAll

Java EE Security Limitations

- No error messages for failed logins
- No Remember Me
- Container has to be configured
- Doesn't support regular expressions for URLs

Spring Security

- Filter defined in web.xml
- Separate security context file loaded by Spring
  - Defines URLs, Roles and Authentication Providers
  - Defines UserService (provided or custom)
- Password Encoding
- Remember Me

Spring Security Demo

http://www.youtube.com/watch?v=poc5dyImbig

Securing Methods

<global-method-security secured-annotations="enabled"/>

```
@Secured("IS_AUTHENTICATED_ANONYMOUSLY")
public Account readAccount(Long id);

@Secured("IS_AUTHENTICATED_ANONYMOUSLY")
public Account[] findAccounts();

@Secured("ROLE_TELLER")
public Account post(Account account, double amount);
```

<global-method-security jsr250-annotations="enabled"/>

Securing Methods 3.x

```
<global-method-security pre-post-annotations="enabled"/>
```

```
@PreAuthorize("isAnonymous()")
public Account readAccount(Long id);

@PreAuthorize("isAnonymous()")
public Account[] findAccounts();

@PreAuthorize("hasAuthority('ROLE_TELLER')")
public Account post(Account account, double amount);
```

Spring Security Limitations

- Authentication mechanism in WAR
- Securing methods only works on Spring beans
- My remember me example doesn't work

Apache Shiro

- Filter defined in web.xml
- shiro.ini loaded from classpath
  - [main], [urls], [roles]
- Cryptography
- Session Management

Apache Shiro Demo

http://www.youtube.com/watch?v=YJByiDvOhsc

Apache Shiro Limitations

- Limited Documentation
- Getting Roles via LDAP not supported
- No out-of-box support for Kerberos
- REST Support needs work

Testing with SSL

- Cargo doesn't support http and https at same time
- Jetty and Tomcat plugins work for both
- Pass javax.net.ssl.trustStore & javax.net.ssl.trustStorePassword to maven-failsafe-plugin as <systemPropertyVariables>

Ajax Login

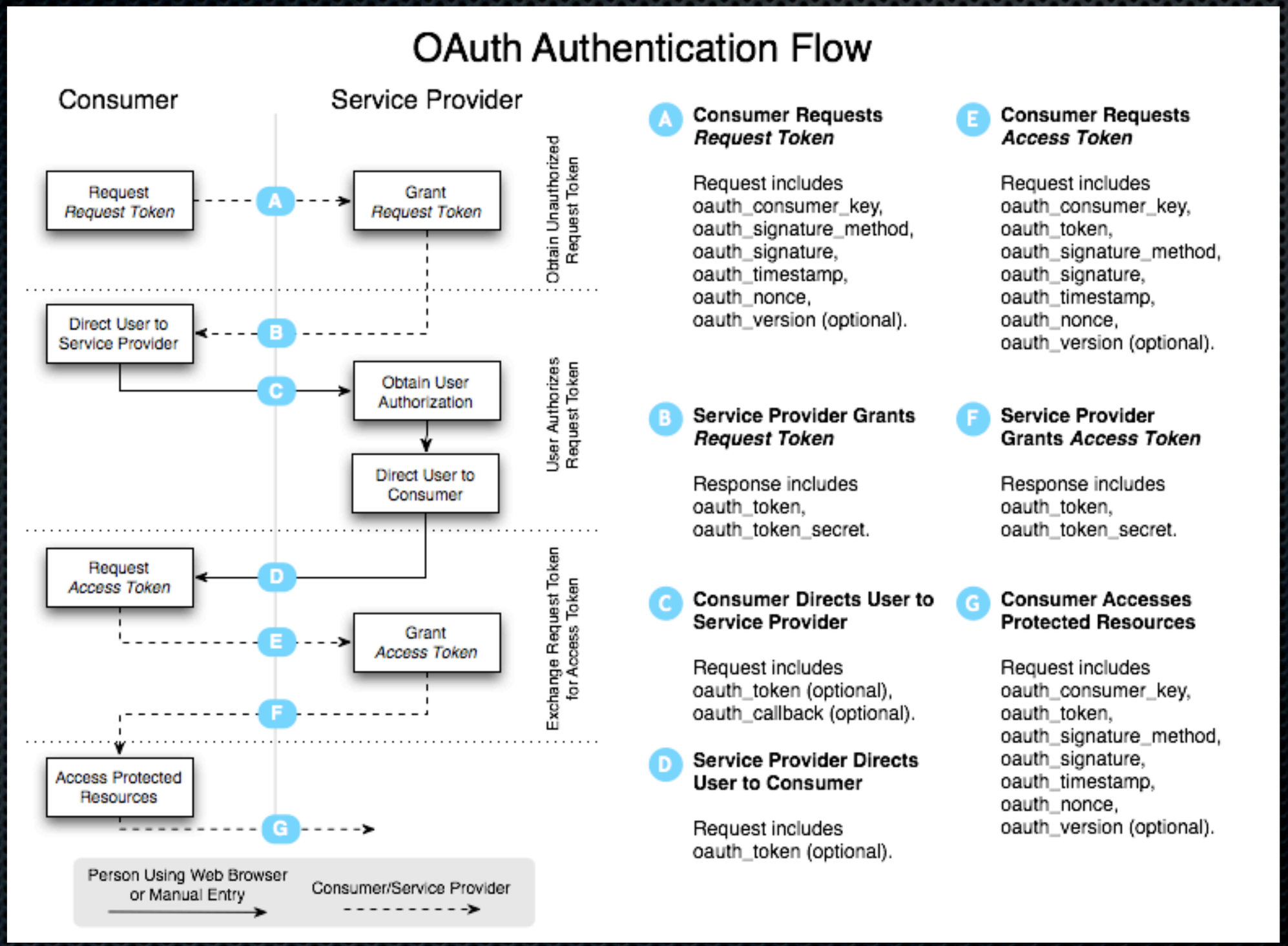
```
package org.appfuse.examples.webapp.security;

import javax.servlet.*;
import javax.servlet.http.HttpServletResponse;
import java.io.IOException;

public class OptionsHeadersFilter implements Filter {

    public void doFilter(ServletRequest req, ServletResponse res, FilterChain chain)
            throws IOException, ServletException {
        HttpServletResponse response = (HttpServletResponse) res;

        response.setHeader("Access-Control-Allow-Origin", "http://" + req.getServerName());
        response.setHeader("Access-Control-Allow-Methods", "GET,POST");
        response.setHeader("Access-Control-Max-Age", "360");
        response.setHeader("Access-Control-Allow-Headers", "x-requested-with");
        response.setHeader("Access-Control-Allow-Credentials", "true");

        chain.doFilter(req, res);
    }

    public void init(FilterConfig filterConfig) {
    }

    public void destroy() {
    }
}
```

http://raibledesigns.com/rd/entry/implementing_ajax_authentication_using_jquery

Securing a REST API

- Use Basic or Form Authentication
- Use Developer Keys
- Use OAuth

OAuth



REST Security and OAuth Demo

http://raibledesigns.com/rd/entry/implementing_oauth_with_gwt

http://raibledesigns.com/rd/entry/grails_oauth_and_linkedin_apis

Integrating OAuth with AppFuse and REST

http://raibledesigns.com/rd/entry/integrating_oauth_with_appfuse_and

REST Security Resources

- Implementing REST Authentication
  - http://www.objectpartners.com/2011/06/16/implementing-rest-authentication/
- Swagger ApiAuthorizationFilter
  - https://github.com/wordnik/swagger-core/tree/master/samples/java-jaxrs

REST Security Resources

- Spring Security OAuth
  - version 1.0.1
- Spring Social
  - version 1.0.2
    - Facebook, Twitter, LinkedIn, TripIt, and GitHub Bindings

Penetrate

- OWASP Testing Guide and Code Review Guide
- OWASP Top 10
- OWASP Zed Attack Proxy
- Burp Suite
- OWASP WebGoat

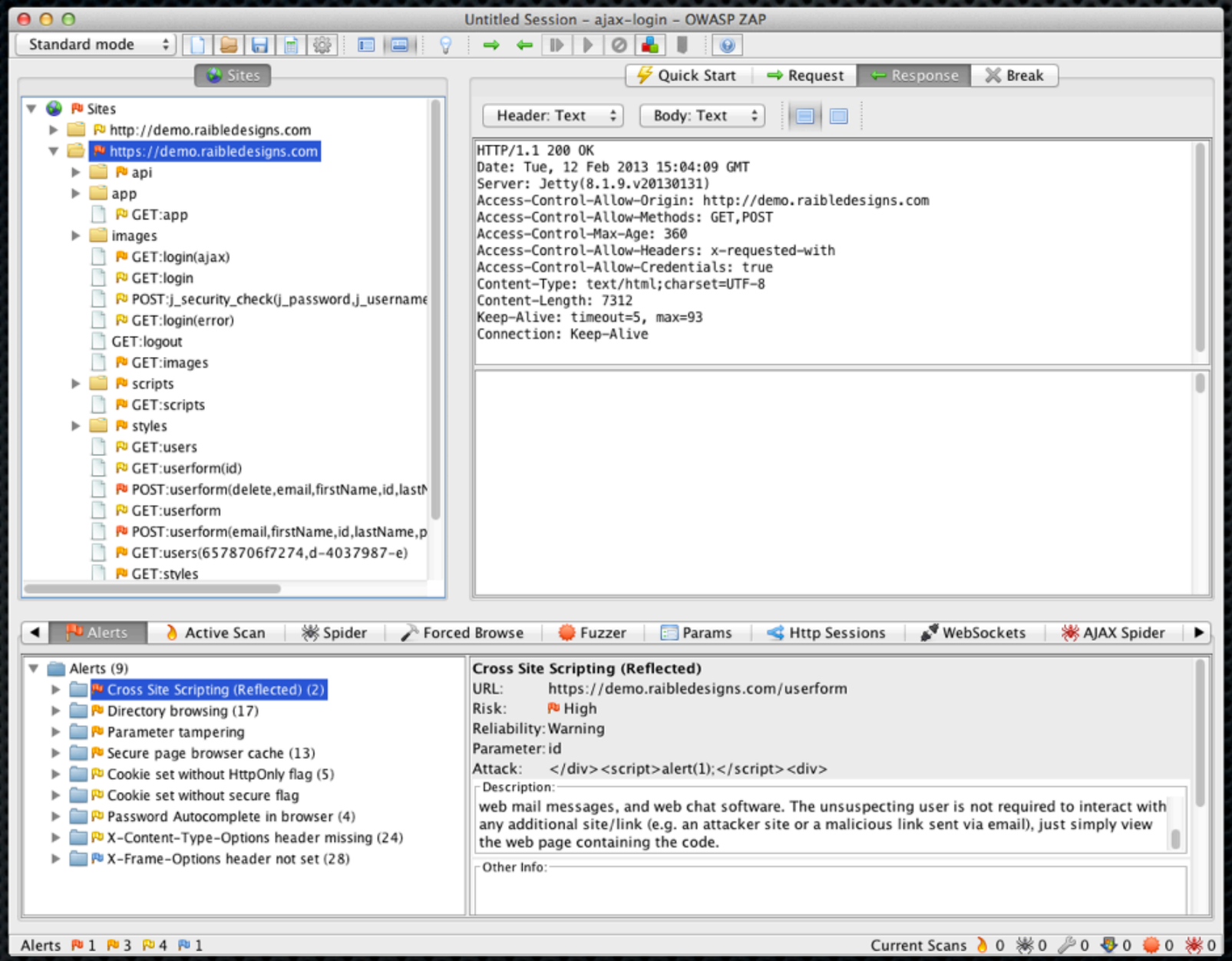
OWASP

- The Open Web Application Security Project (OWASP) is a worldwide not-for-profit charitable organization focused on improving the security of software.

- At OWASP you'll find free and open ...
  - Application security tools, complete books, standard security controls and libraries, cutting edge research
  - http://www.owasp.org

OWASP
The Open Web Application Security Project

Penetration Testing Demo



http://raibledesigns.com/rd/entry/java_web_application_security_part4

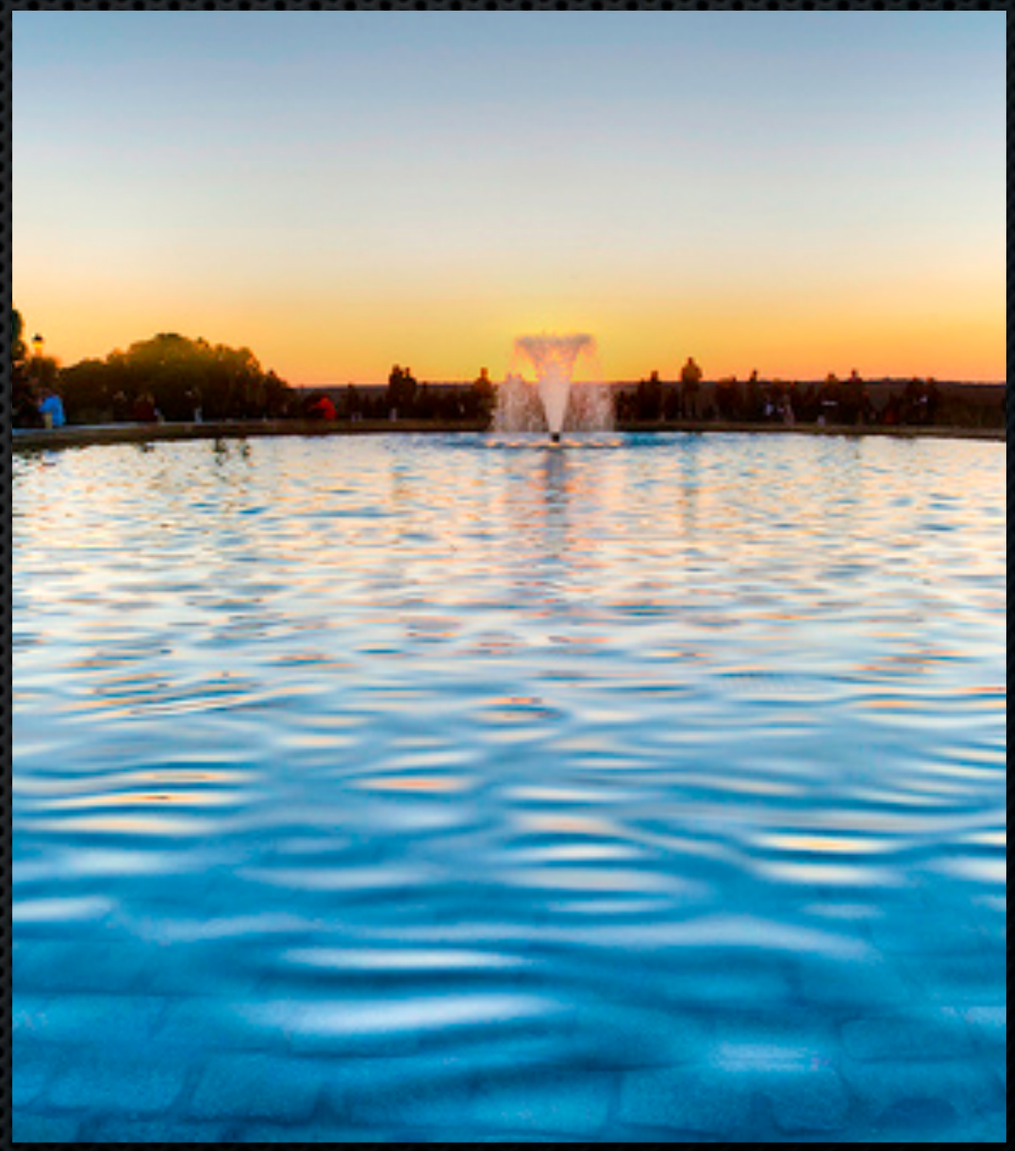
Fixing ZAP Vulnerabilities

```
<session-config>
    <session-timeout>15</session-timeout>
    <cookie-config>
        <http-only>true</http-only>
        <secure>true</secure>
    </cookie-config>
    <tracking-mode>COOKIE</tracking-mode>
</session-config>
```

```
<form action="${ctx}/j_security_check" id="loginForm"
      method="post" autocomplete="off">
```

7 Security (Mis)Configurations in web.xml

1. Error pages not configured
2. Authentication & Authorization Bypass
3. SSL Not Configured
4. Not Using the Secure Flag



http://software-security.sans.org/blog/2010/08/11/security-misconfigurations-java-webxml-files

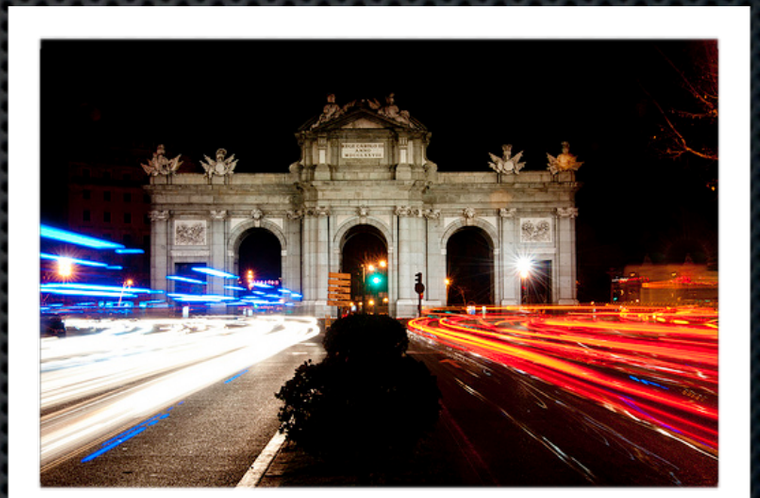
7 Security (Mis)Configurations

5. Not Using the HttpOnly Flag
6. Using URL Parameters for Session Tracking
7. Not Setting a Session Timeout

http://software-security.sans.org/blog/2010/08/11/security-misconfigurations-java-webxml-files

OWASP Top 10 for 2010

1. Injection
2. Cross-Site Scripting (XSS)
3. Broken Authentication and Session Management
4. Insecure Direct Object References
5. Cross-Site Request Forgery (CSRF)



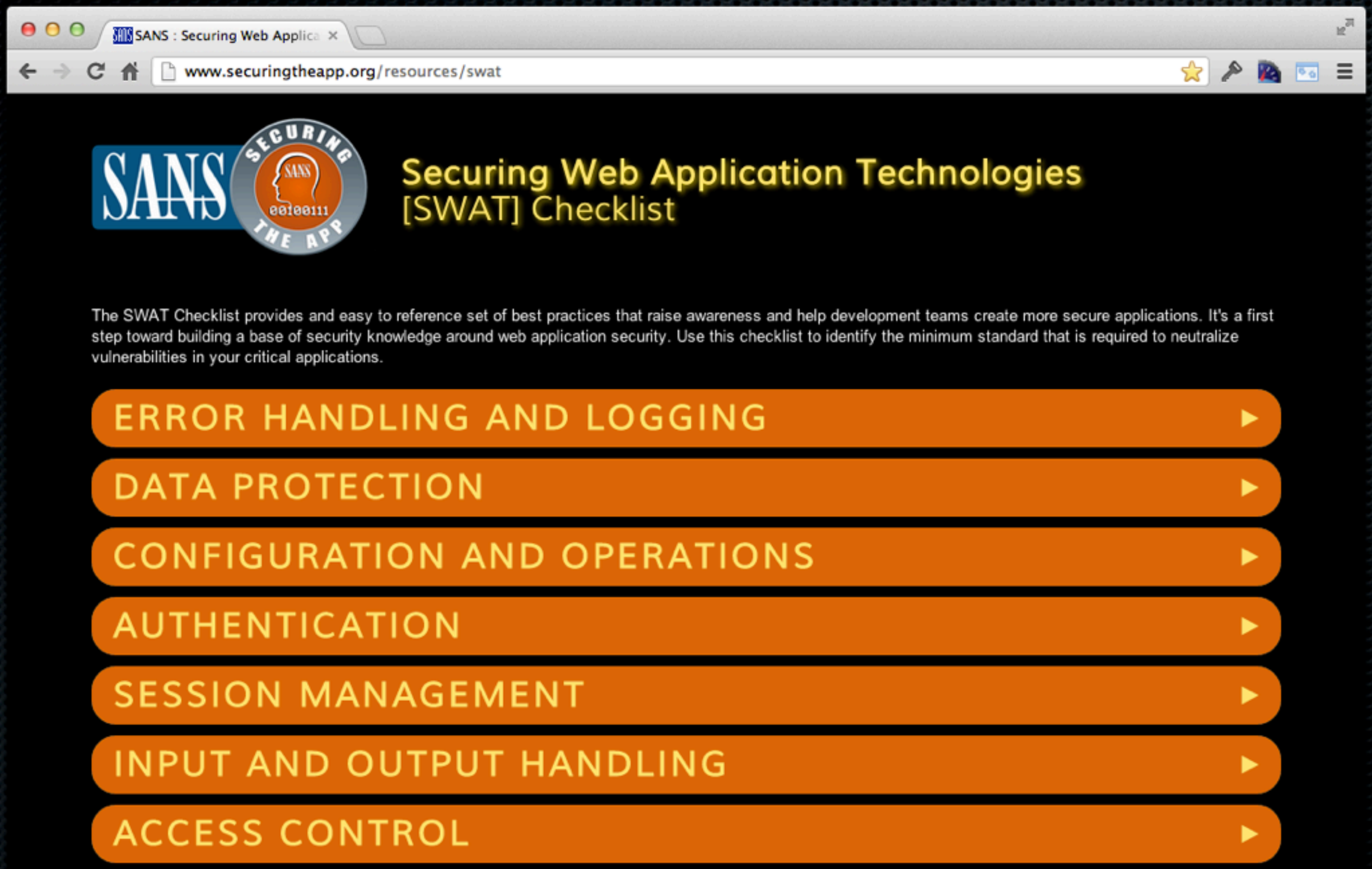
OWASP Top 10 for 2010

6. Security Misconfiguration
7. Insecure Cryptographic Storage
8. Failure to Restrict URL Access

9. Insufficient Transport Layer Protection
10. Unvalidated Redirects and Forwards

Protect

- [SWAT] Checklist
- Firewalls
- IDS and IDPs
- Audits
- Penetration Tests
- Code Reviews with Static Analysis Tools

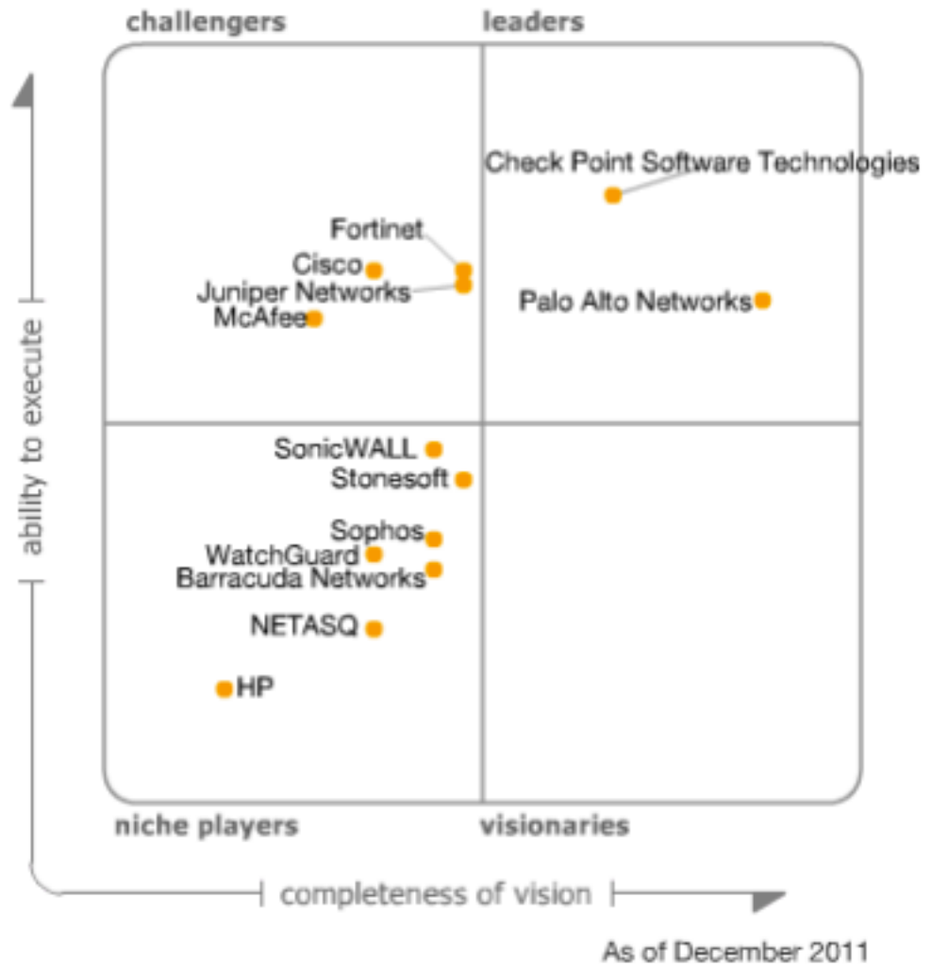


Firewalls

- Stateless Firewalls
- Stateful Firewalls
  - Invented by Nir Zuk at Check Point in the mid-90s
- Web App Firewalls
  - Inspired by the 1996 PHF CGI exploit
  - WAF Market $234m in 2010

Gartner on Firewalls

Figure 1. Magic Quadrant for Enterprise Network Firewalls



Source: Gartner (December 2011)

Content Security Policy

- An HTTP Header with whitelist of trusted content
- Bans inline <script> tags, inline event handlers and javascript: URLs
- No eval(), new Function(), setTimeout or setInterval
- Supported in Chrome 16+, Safari 6+, and Firefox 4+, and (very) limited in IE 10

Content Security Policy

```
Content-Security-Policy: script-src 'self' https://apis.google.com
```

Relax

- **Web App Firewalls**: Imperva, F5, Breach
  - **Open Source**: WebNight and ModSecurity
- **Stateful Firewalls**: Juniper, Check Point, Palo Alto
- **IDP/IDS**: Sourcefire, TippingPoint
  - **Open Source**: Snort
- **Audits**: ENY, PWC, Grant Thornton
- **Pen Testing**: WhiteHat, Trustwave, Electric Alchemy
  - **Open Source**: OWASP ZAP
- **Static Analysis**: Fortify, Veracode

Remember...

"Security is a quality, and as all other quality, it is important that we build it into our apps while we are developing them, not patching it on afterwards like many people do." -- *Erlend Oftedal*

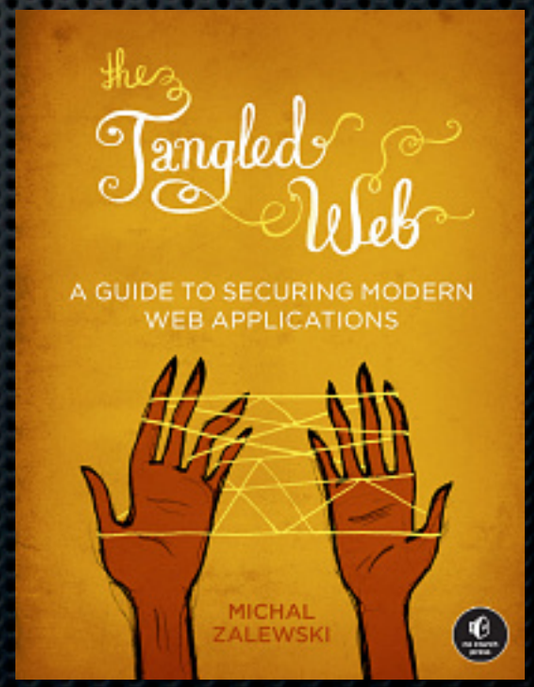
From a comment on my blog: http://bit.ly/mjufjR

Action!

- Use OWASP and Open Source Security Frameworks
  - Don’t be afraid to contribute!
- Follow the Security Street Fighter Blog
  - http://software-security.sans.org/blog
- Use OWASP ZAP to pentest your apps
- Don’t be afraid of security!

Additional Reading

- Securing a JavaScript-based Web Application
  - http://eoftedal.github.com/WebRebels2012
- Michal Zalewski's "The Tangled Web"
  - http://lcamtuf.coredump.cx/tangled



Additional Resources

- OWASP Denver
  - https://www.owasp.org/index.php/Denver
  - Next Meeting: Wednesday, February 20, 6-8pm
- Front Range OWASP Security Conference
  - March 28 - 29 in Denver
- David Campbell of Electric Alchemy
  - http://www.electricalchemy.net

Questions?

Contact Information

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My Presentations

http://slideshare.net/mraible