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Secure Parameter Filter (SPF)

(AKA Protecting Vulnerable Applications with IIS7)

Justin Clarke, Andrew Carey Nairn

Our Observations

- The same old code-level problems
  - Input Validation, Parameter Manipulation, Authorization Bypass, Privilege Escalation, Reliance on Browser Security, etc, etc, etc…
- Can we EVER prevent these?
  - Developer Training? There are always "mistakes"
  - Negative Security Model? Almost always can bypass
  - Positive Security Model? Very difficult to implement

What should we do?

- Root Cause Analysis:
  - **Problem:** The application allowed the user to do something they shouldn't have been able to do
  - **Solution:** Only allow the user do what the application expects them to be able to do
- How???
  - Look at what the application presents to the user
  - If an option is not presented, don't let them use it
  - If we don't ask the user for it, don't accept it!

Secure Parameter Filter (SPF)

- What is SPF?
  - Embedded application "Security Filter"
  - Analyses incoming requests and outgoing responses
  - Every URL and input value requires a security token
    - Generated on-the-fly as pages are rendered
    - Exceptions can be defined for certain pages/inputs
  - Deployed at the application level
    - No involvement from server administrator required

Secure Parameter Filter (SPF)

- Designed to protect against:
  - **Input Tampering & Injection**
    Query String, Cookies, Form Inputs
  - **URI Tampering**
    Forced Browsing
  - **Forgery, Hijacking / Cross-Site Attacks**
    Session-Based Tokenization

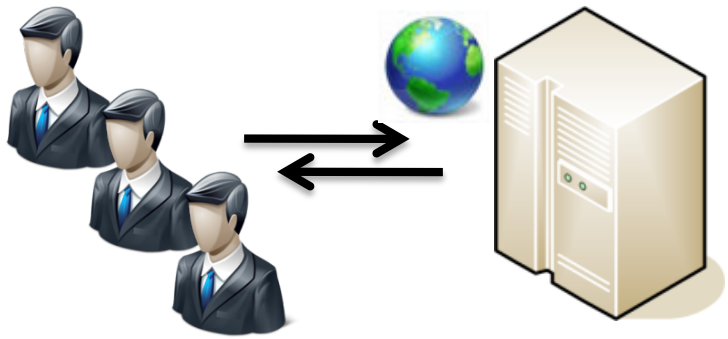
How it Works

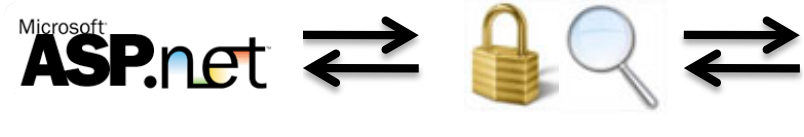
- Output Filter
  - Analyzes HTTP output to determine what is presented
  - Only URLs and inputs presented to the user are permitted on subsequent requests
    - Append Cryptographic Token on each URL
      - Link HREF, Form ACTION, Script & Frame SRC
    - Insert unique GUID on each form and record form input profile (name, type, disabled/read-only)
    - Encrypt eligible embedded Form input values
      - ASP.NET Machine Key

How it Works

- Input Filter
  - Analyzes HTTP request to ensure it is for only authorized URLs and inputs
  - By default, only pre-determined "entry points" are permitted without a proper request token
  - Inspect free-form text inputs against specified regular expressions (optional)

How it Works





FRAMEWORK HANDLER | **SPF** | **CUSTOM CODE**

APPLICATION USERS

IIS WEB/APP SERVER

INTERNAL WEB/APP SERVER PROCESSING

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Applied Cryptography in SPF

- Encrypted Inputs
  - 16 Random Bytes Pre-Pended to Each Value
    - Produces Unique Cipher Text (similar to IV)
  - Uses ASP.NET Machine Key to Encrypt
  - Appends Time Stamp & SHA1 HMAC
    - Cipher Text
    - Time Stamp
    - Source IP Address
    - Source Guid (SPF Cookie)

Applied Cryptography in SPF

- Tokenized Elements
  - Appends Time Stamp & SHA1 HMAC
    - Plain-Text (URL, Query String)
    - Time Stamp
    - Source IP Address
    - Source Guid (SPF Cookie)
    - HMAC Key derived from ASP.NET Machine Key

Configuration Requirements

- Default Protection Settings (Required)
  - Protection Scope (URI, QueryString, Forms, Cookies)
  - Main Application Entry Point (URL)
- Exceptions to Default Settings (Optional)
  - Global Exceptions (Form Inputs, Cookies)
  - URI Exceptions (URI, Query String, Form Inputs)

Configuration Options

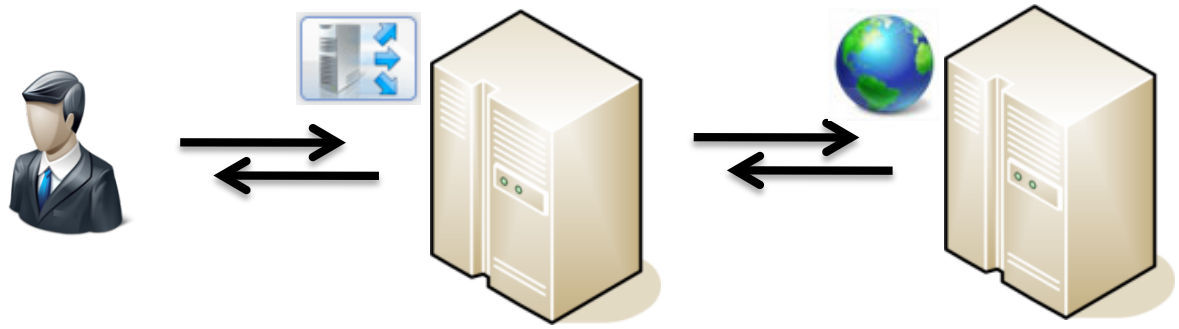
- Automatic Run-time Configuration Updates
  - Ineligible inputs are automatically granted exceptions
    - INPUT TYPE=TEXT, TEXAREA, etc
- "Black List" Regular Expression Filter
  - Used to optionally block malicious input strings
- Two Modes of Operation
  - Passive: Silent logging of all failed requests
  - Active: Failed requests are rejected

Supported Content Types

- HTML Analyzer
  - Uses HTML Agility Pack
- JavaScript Analyzer
  - Custom functions with arguments that include URLs and request parameters
    - __doPostBack(eventTarget, eventArgument)
  - Native properties that contain URLs
    - location.href, window.location, etc

SPF Reverse Proxy Test Cases

- IIS7 Reverse Proxy allows SPF to protect any web application
  - Used to perform testing against several applications
  - Can be leveraged to determine compatibility with SPF



SPF TESTER / EVALUATOR | **SPF REVERSE PROXY (IIS7)** | **WEB/APP SERVER**

Live Demonstration

DEMO

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Questions

- Justin Clarke - justin @ gdssecurity . com
- Andrew Carey Nairn – andrew @ gdssecurity . com

- GDS Blog:
  - http://www.gdssecurity.com/l/b