Flash Security

Arcus Security GmbH

Zürich, 20.8.2014

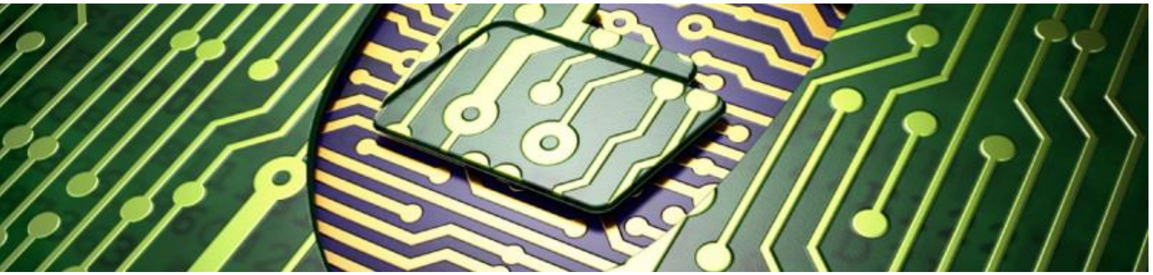
Introduction Speaker

- Stefan Horlacher
  - Founder of Arcus Security
    - Penetration Testing
    - Web Application Reviews
    - Remediation of vulnerabilities
    - www.arcus-security.ch

Agenda

Foreword

- This presentation summarises security relevant material from a client side perspective
- A lot of public knowledge can be found on
  - Adobe web site
  - OWASP web site



Introduction

Introduction

- SWF pronounced
  - Swif
- Dialect of ECMAScript
  - JavaScript alike
- ActionScript
  - 2000 ActionScript 1.0
  - 2003 ActionScript 2.0
  - 2006 ActionScript 3.0

Introduction

- Purposes
  - Animations
  - Games
  - Rich Internet Applications (RIA)
  - …

Introduction

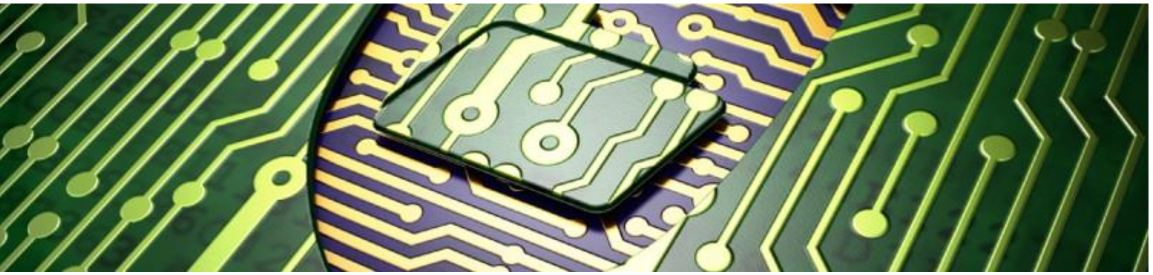
- Files and execution environments
  - Browser Plug-ins
    - Plays SWF files
    - Embedded in <object> / <embed> tag
    - Direct call to the SWF file
      - Browser Plug-in creates the DOM
    - Plug-ins use the browser’s SSL / TLS implementation
    - Byte Code (JIT Compiler)

Introduction

- Files and execution environments
  - Standalone player
    - Plays SWF files
    - SSL / TLS available
  - Projector
    - .exe files
    - Standalone player containing the SWF
      - Specific version
    - No SSL / TLS
    - Creation not supported in Standalone player anymore

Introduction

- Cookies
  - HttpOnly flag prevents Flash from reading the cookie
  - Requests send cookies if any are present
    - HttpOnly flag has no influence in this case



Sandboxes

Sandboxes

- local-with-file-system
    - Access to local resources
    - Access to UNC network path
- local-with-networking
    - Access to network resources
- local-trusted
    - Not restricted

Sandboxes

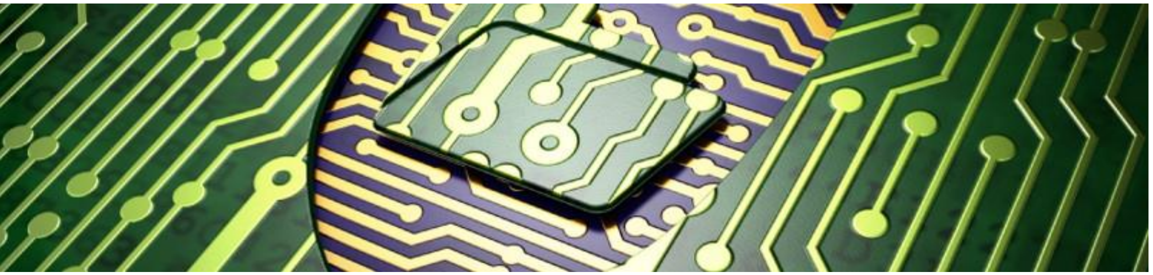
- remote
  - No access to local file system
    - Except Local Shared Objects
    - Except Upload / Download API calls
      - Have to be called in a mouse or keyboard event

Sandboxes

- SWF loaded locally
  - Sandbox setting is part of the binary (flag)
    - local-with-file-system
    - local-with-networking

Sandboxes

- SWF loaded locally
  - local-trusted has to be granted by
    - Installer
    - Administrator
    - User
    - (or Projector files)
  - Local trusted files are defined in configuration files
    - Global / User FlashPlayerTrust directory
    - Or in settings.sol



Local Shared Objects

Local Shared Objects

- Also known as Flash Cookies
  - Used to persist on computer
  - Private browsing deletes Flash Cookies!
    - Since Flash Player 10.1
- The only type of persistent storage
- Limited disk space
  - Default 100KB

Local Shared Objects

- Object encoding is AMF
  - Actionscript 1.0 / 2.0
    - AMF0
  - Actionscript 3.0
    - AMF3
    - Downgrade to AMF0 is possible

Local Shared Objects

- Stored locally in the user's app data directory
  - Directory name is #SharedObjects
  - Path contains a random value (LLWKHP8Z)
  - Example
    - C:\users\<user>\AppData\Roaming\Macromedia\Flash Player\#SharedObjects\LLWKHP8Z\<domain>\<SWF Name>\<LSO Name>.sol
  - Local (Standalone player) SWFs contain the sandbox in the path
    - ..\LLWKHP8Z\#localWithNet\<SWF path>

Local Shared Objects

- SharedObject.getLocal(name, path, secure)
  - Name of the LSO
  - Path of the LSO
    - ‘/’ is equal to the sandbox
      - Browser => domain name
      - Standalone player => local sandbox
        - E.g: #localWithNet

Local Shared Objects

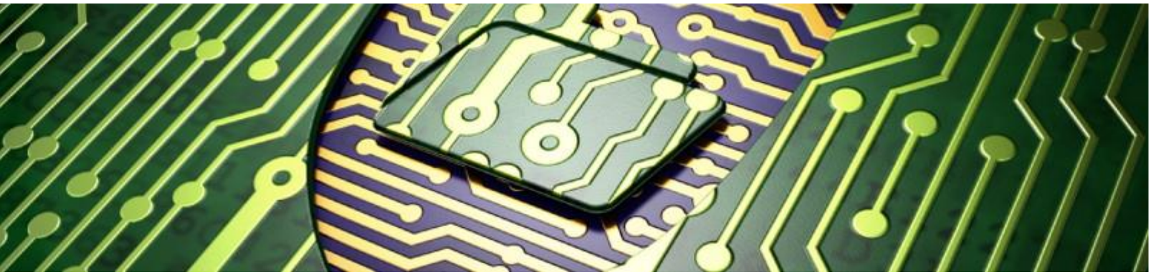
- SharedObject.getLocal(name, path, secure)
  - Path of the LSO
    - Path has to be part of the URL
      - www.example.com/files/myswf/path.swf
        - Only access to ‘/’, ‘/files’ and ‘/files/myswf’
      - www.example.com/files/anotherswf/path2.swf
        - Has access to /files
        - Doesn’t have access to ‘/files/myswf’
      - Without path specification an additional directory is created with name of the SWF
        - ../example.com/files/myswf/path.swf/<LSO Name>.sol

Local Shared Objects

- SharedObject.getLocal(name, path, secure)
    - Secure
        - Access to the LSO is only possible if the SWF is served over HTTPS

Local Shared Objects

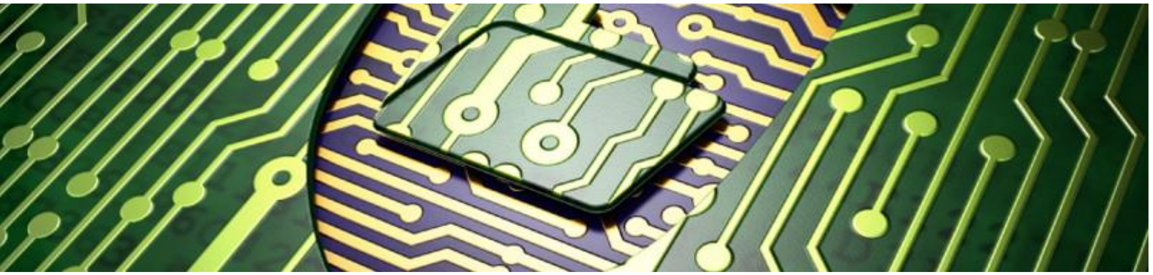
- Remote Shared Objects exist as well
    - They require Adobe Flash Media Server
    - Share data between clients
    - Share data in real time



Configuration Overview

Configuration Overview

- Client Side
  - Administrative configuration
  - User configuration
- Flash Application
  - Author / Developer
- Remote
  - Cross domain policies



Client Side Configuration

Client Side Configuration

- mms.cfg (Administrative configuration)
  - Deployed by an administrator
  - Enforcing corporate
    - Security settings
    - Privacy settings
  - Location is OS / architecture dependent
    - E.g. Windows 64 bit:
      - %WINDIR%\SysWow64\Macromed\Flash

Client Side Configuration

- mms.cfg
  - Privacy options
    - AWHardwareDisable
    - AWHardwareEnabledDomain
    - DisableDeviceFontEnumeration
  - User interface options
    - FullScreenDisabled

Client Side Configuration

- mms.cfg
  - Data loading and storage options
    - LocalFileReadDisable
    - FileDownloadDisable / FileDownloadEnabledDomain
    - FileUploadDisable / FileUploadEnabledDomain
    - LocalStorageLimit
    - ThirdPartyStorage
    - AssetCacheSize

Client Side Configuration

- mms.cfg
  - Update Options
    - AutoUpdateDisable
    - AutoUpdateInterval
    - SilentAutoUpdateEnable
    - SilentAutoUpdateServerDomain
    - SilentAutoUpdateVerboseLogging
    - DisableProductDownload
    - ProductDisabled

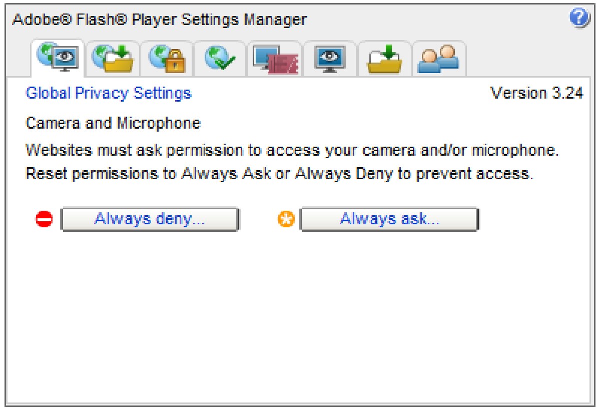
Client Side Configuration

- mms.cfg
  - Security options
    - LegacyDomainMatching
    - AllowUserLocalTrust
    - FullScreenInteractiveDisable

Client Side Configuration

- User Configuration
  - Deprecated way to configure Flash
  - http://www.adobe.com/support/documentation/en/flashplayer/help/settings_manager.html

Global Privacy Settings panel



Adobe® Flash® Player Settings Manager

Global Privacy Settings Version 3.24

Camera and Microphone

Websites must ask permission to access your camera and/or microphone.
Reset permissions to Always Ask or Always Deny to prevent access.

Note: The Settings Manager that you see above is not an image; it is the actual Settings Manager. Click the tabs to see different panels, and click the options in the panels to change your Adobe Flash Player settings.

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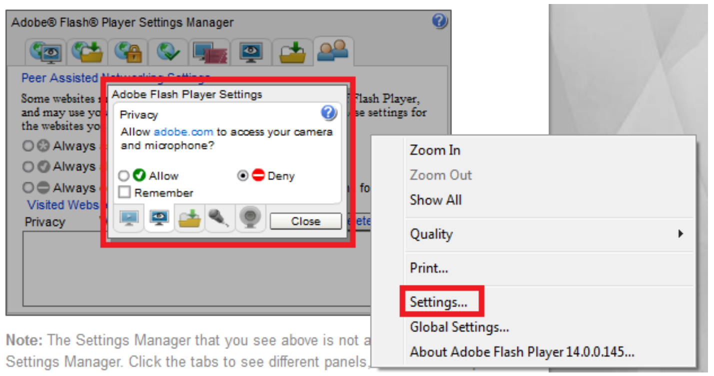
Client Side Configuration

- User Configuration
  - Display
  - Privacy
    - Microphone / Camera
  - Local Storage
  - Microphone
  - Camera


Adobe® Flash® Player Settings Manager

Peer Assisted Networking Settings

Adobe Flash Player Settings

Privacy

Allow adobe.com to access your camera and microphone?

Allow [✓ Deny]

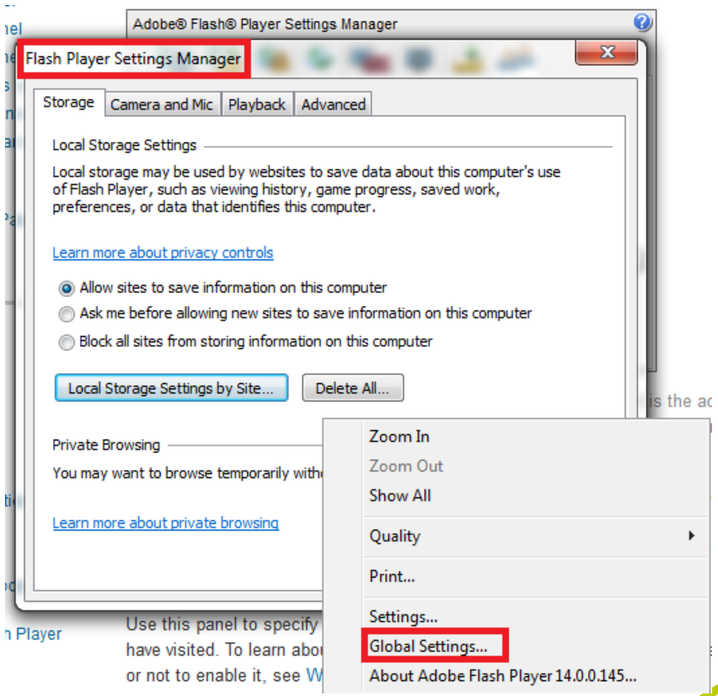
Remember

Note: The Settings Manager that you see above is not a

Settings Manager. Click the tabs to see different panels

Client Side Configuration

- User Configuration
  - Also available through the Control Panel



Adobe® Flash® Player Settings Manager

Flash Player Settings Manager

Storage | Camera and Mic | Playback | Advanced

Local Storage Settings

Local storage may be used by websites to save data about this computer's use of Flash Player, such as viewing history, game progress, saved work, preferences, or data that identifies this computer.

Learn more about privacy controls

[✓ Allow sites to save information on this computer]
Ask me before allowing new sites to save information on this computer
Block all sites from storing information on this computer

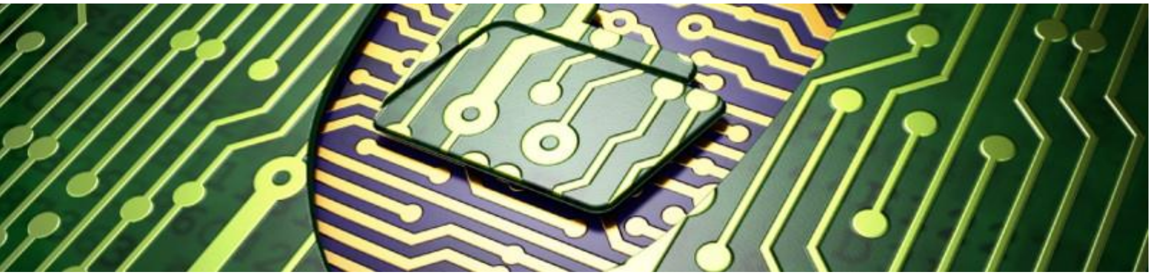
Local Storage Settings by Site... | Delete All...

Private Browsing

You may want to browse temporarily with

Learn more about private browsing

Use this panel to specify
have visited. To learn abo
or not to enable it, see W



Embedding Flash

Embedding Flash

- SWFs can be embedded in different ways
  - Directly in the HTML
  - Directly calling the SWF in the browser
    - This will generate a DOM in the background
  - JavaScript libraries
    - E.g.: swfobject

Embedding Flash

- allowScriptAccess
  - Defines if the SWF is allowed to run scripts in the context of the embedding web site
  - Values
    - always (default in older Flash versions)
      - Regardless of the SWFs location, it is allowed to communicate with the embedding web site
    - sameDomain (default in newer Flash versions)
      - SWF may communicate with the embedding web site if they are hosted on the same domain
    - never (deprecated)

Embedding Flash

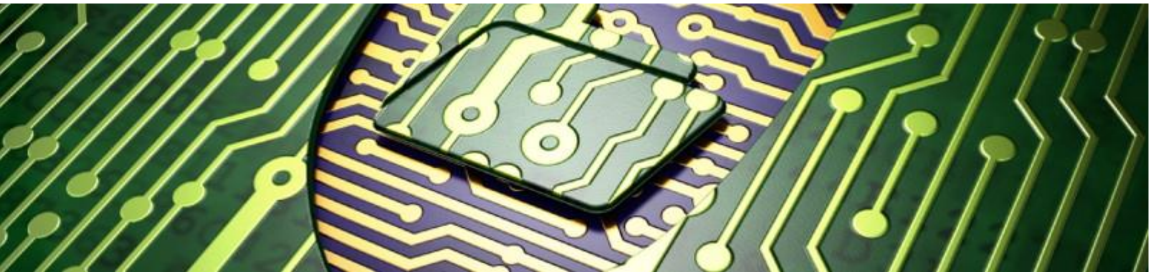
- allowNetworking
    - Defines how the SWF is allowed to make network calls
    - Values
        - all (default)
            - No restrictions
        - internal
            - Restricted network calls
        - none

Embedding Flash

- allowNetworking supersedes allowScriptAccess
  - E.g.: ‘allowNetworking = none’ makes allowScriptAccess obsolete

Embedding Flash

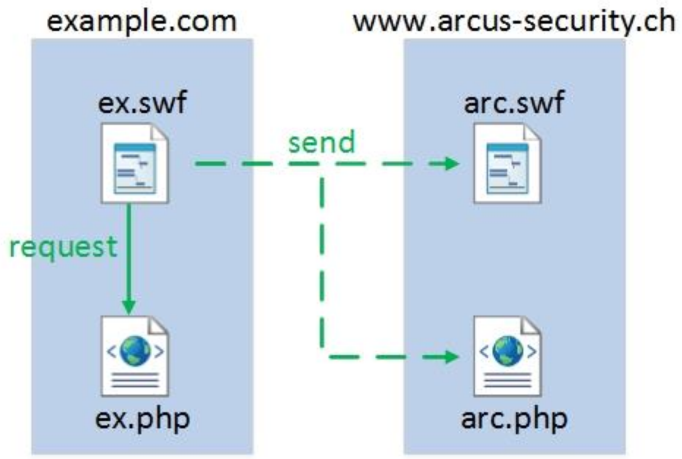
- DO NOT host an untrusted SWF on a trusted domain
  - allowScriptAccess and allowNetworking won't prevent exploitation of vulnerabilities
  - SWF object may be directly invoked (URL)
    - The created DOM has the default values for allowScriptAccess and allowNetworking
    - Therefore, these settings may be bypassed!
      - Reason why allowScriptAccess = never is deprecated



Cross Domain Policies

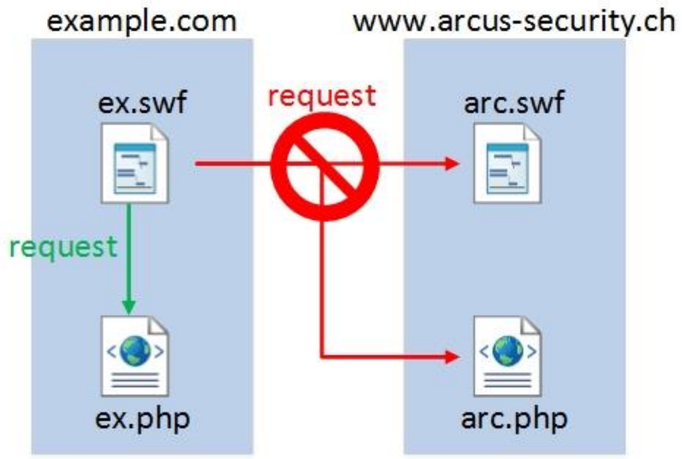
Cross Domain Policies

- Request / Send on same domain
  - No policy required
- Send to foreign domain
  - GET don't require a cross domain policy
  - POST require a cross domain policy
    - E.g.: sendToURL() method



Cross Domain Policies

- Requests to foreign domains
  - Require cross domain policy



Cross Domain Policies

- Why do we need a cross domain policy?
  - Flash would have full access to the foreign domain’s content
    - Reading sensitive content
    - Access to the functionality of the application in the context of the current user

Cross Domain Policies

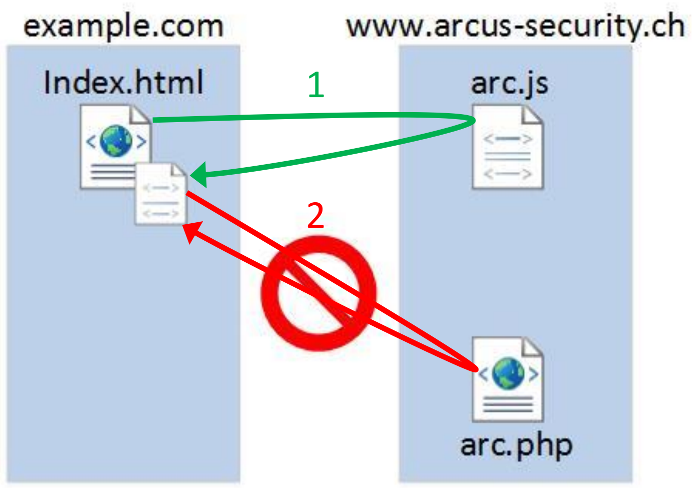
- Cross Domain Request Restrictions
  - Cross-Protocol-Scripting (XPS) Prevention
    - Several ports are blocked by default
      - E.g.: SMPT, telnet
  - A policy file has to allow access
    - URL connections need an URL policy file
      - crossdomain.xml
    - Socket connections need a socket policy file

Cross Domain Policies

- Same Origin Policy
  - Prevents active content from accessing resources residing on a different origin
    - Based on protocol, port and FQDN

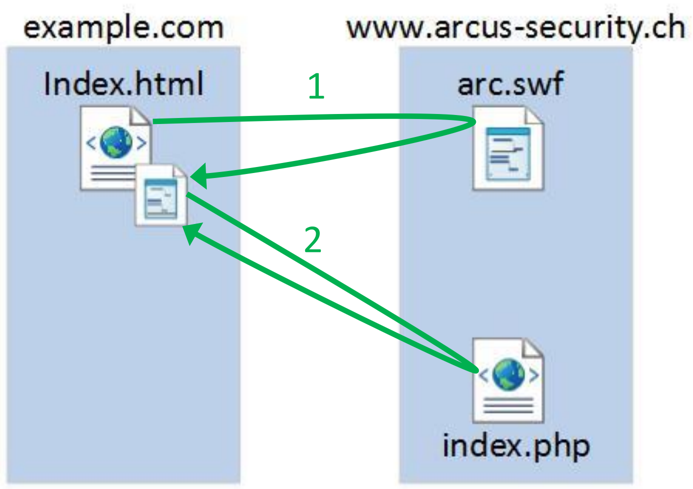
Cross Domain Policies

- Same Origin Policy
  - JavaScript
    - Has only access to the DOM of the embedding page
    - Isn’t able to read content from its origin
      - Exception: Cross Origin Resource Sharing (CORS)



Cross Domain Policies

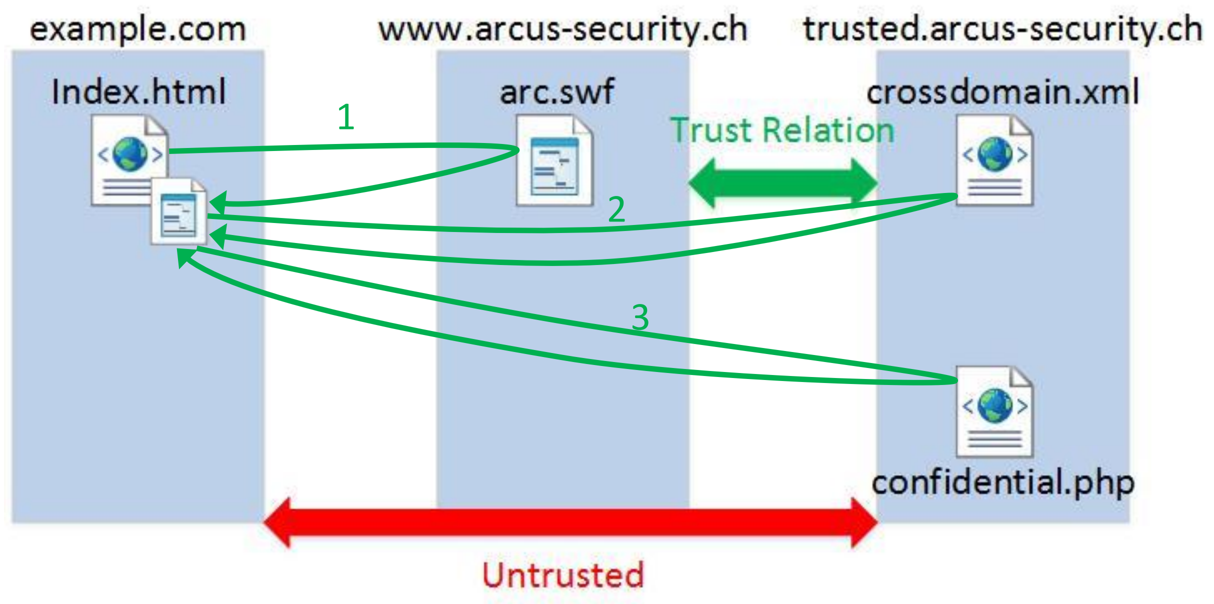
- Same Origin Policy
  - ActionScript
    - Access to the embedding page's DOM depends on allowScriptAccess / allowNetworking
    - Is able to read content from its origin
      - Without requesting a cross domain policy!



Cross Domain Policies

- Same Origin Policy
  - ActionScript
    - The embedded SWF file is in the (remote) sandbox of its origin.
    - Therefore, it has the origin’s trust relationship with other domains!

Cross Domain Policies



Cross Domain Policies

- crossdomain.xml
  - Stored in the server’s web root directory
    - Master policy file
  - By default further policies aren’t permitted

```
<?xml version="1.0"?>
<cross-domain-policy>
    <allow-access-from domain="*"/>
</cross-domain-policy>
```

Cross Domain Policies

- Further policies may be delivered
  - Master policy has to permit meta-policy files
    - Master policy’s meta-policy specification may be overridden by a meta-policy specified in the HTTP response header
      - X-Permitted-Cross-Domain-Policies
    - Meta-policy files have to be loaded manually by the SWF application
      - Security.loadPolicyFile(url:String)

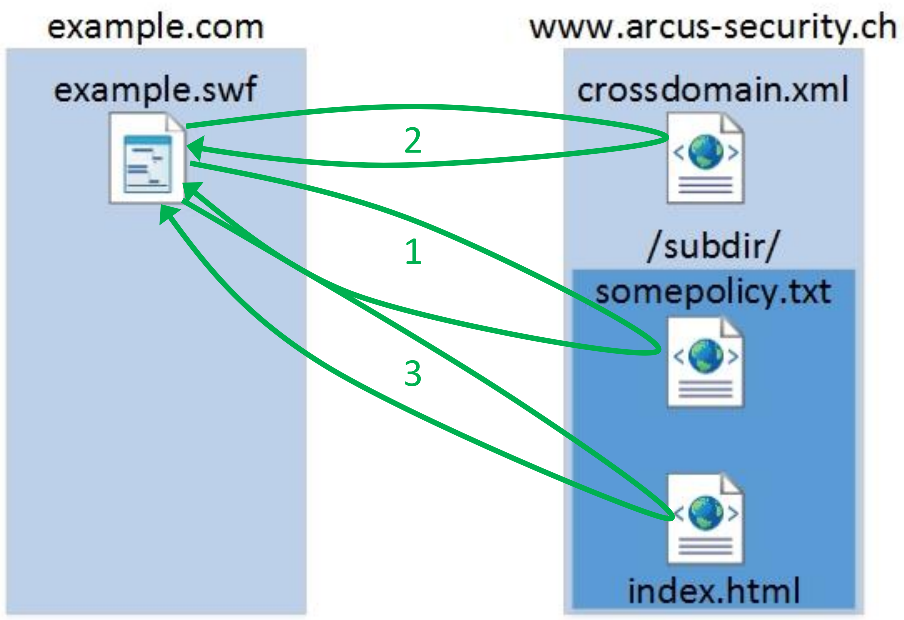
Cross Domain Policies

- Possible meta-policies (master policy configuration)
  - All
  - by-content-type (Content-Type: text/x-cross-domain-policy)
  - by-ftp-filename (/crossdomain.xml)
  - master-only
  - None (ignores even the master policy file)
  - none-this-response (HTTP response header)

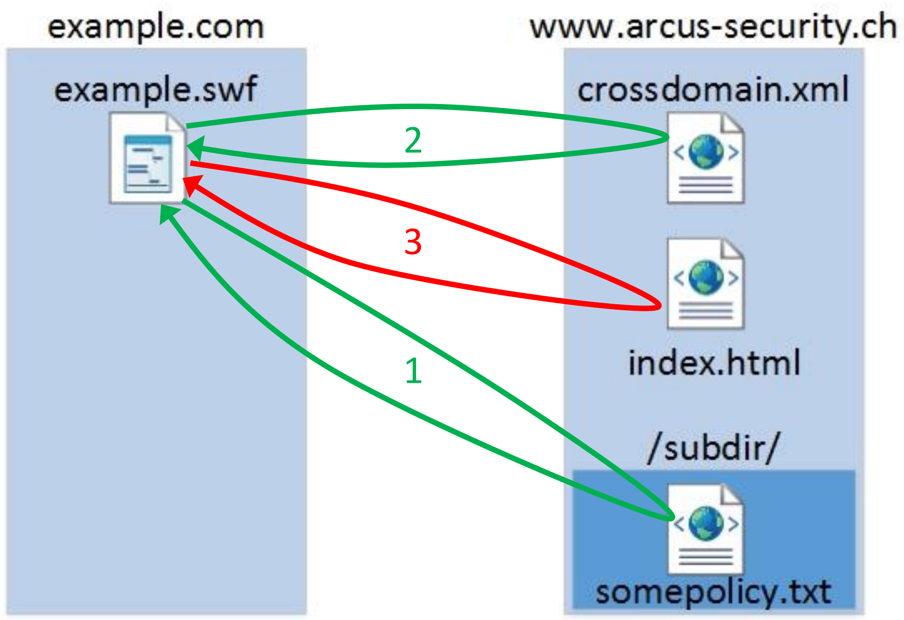
Cross Domain Policies

- Meta-policy restrictions
  - Content-Type
    - text/*
    - application/xml
    - application/xhtml+xml

Cross Domain Policies



Cross Domain Policies



Cross Domain Policies

- Cross Domain Configuration
  - cross-domain-policy
    - site-control
      - permitted-cross-domain-policies
    - allow-access-from
      - domain
      - to-ports (only in socket policies)
      - secure

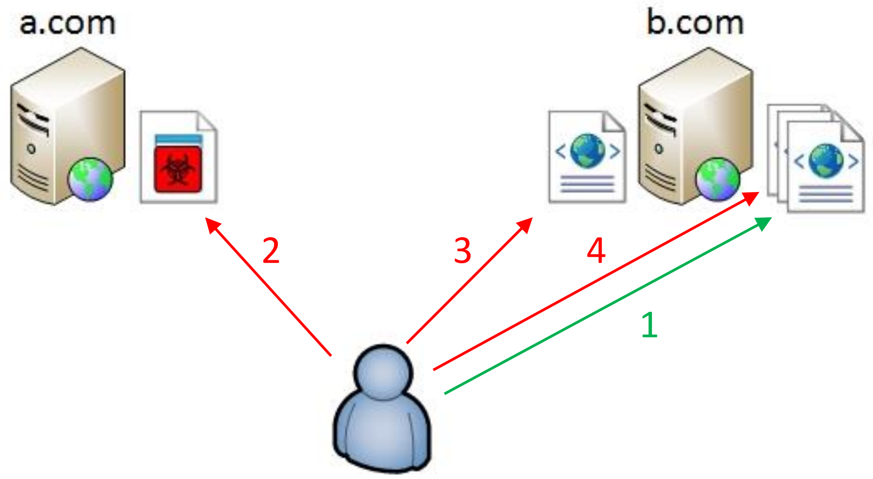
Cross Domain Policies

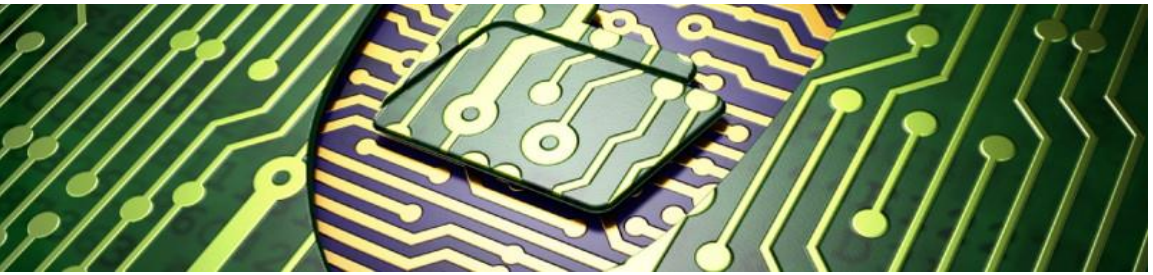
- Cross Domain Configuration
  - cross-domain-policy
    - allow-access-from-identity
      - signatory
        - Certificate
          - fingerprint-algorithm
          - fingerprint

Cross Domain Policies

- Cross Domain Configuration
  - cross-domain-policy
    - allow-http-request-headers-from
      - domain
      - headers

Cross Domain Policies Demo





Common Vulnerabilities

Common Vulnerabilities

- Passing variables to the SWF
  - Flashvars
  - Declared in <embed> / <object> tags
  - Passed as URL parameters
    - myswf.swf?a=a&b=b

Common Vulnerabilities

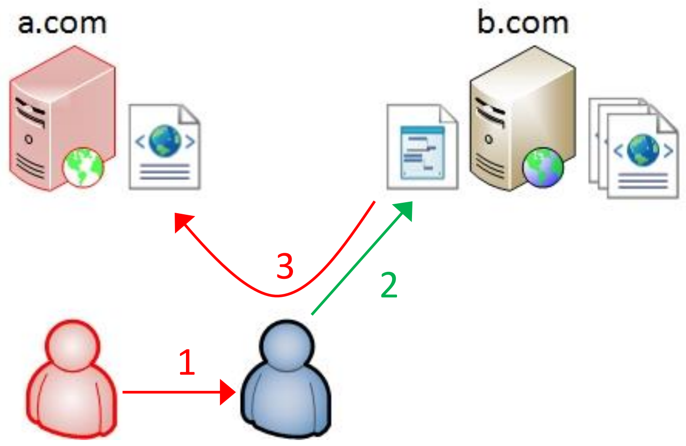
- Reputational Damage
  - Direct embedding
    - Pictures
    - Text
    - Movies
  - ../vulnerable.swf?image=http://a.com/image.gif

Common Vulnerabilities

- Improved Phishing
  - Change of data flow
    - Sensitive data is being sent to an attacker
  - ../vulnerable.swf?

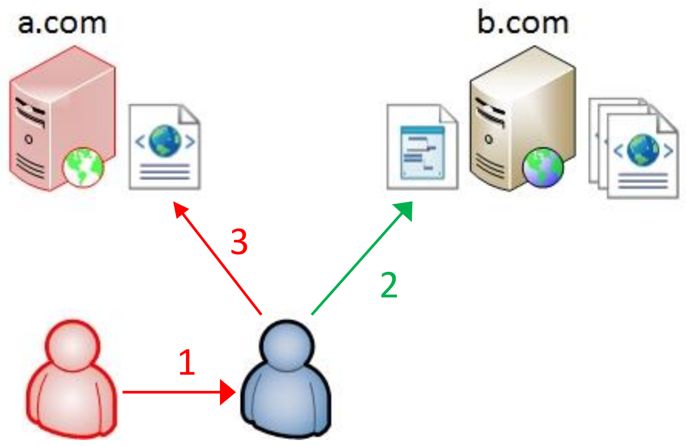
configuration=

http://a.com/my.conf



Common Vulnerabilities

- Redirection Attacks
  - Redirect to
    - Phishing site
    - Malware
    - …
  - ../vulnerable.swf?url=http://a.com/



Common Vulnerabilities

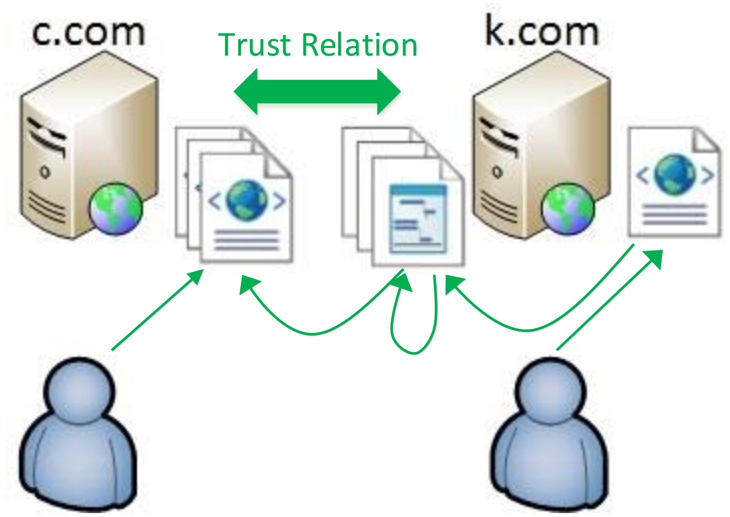
- Cross Site Scripting
  - Access to the DOM
  - Stealing session cookies
  - Redirection attacks
  - Malware Infection
  - Abuse of exposed ActionScript functions
  - ../vulnerable.swf?text=

    <a href=“javascript:alert(1)”>click here</a>
  - javascript:

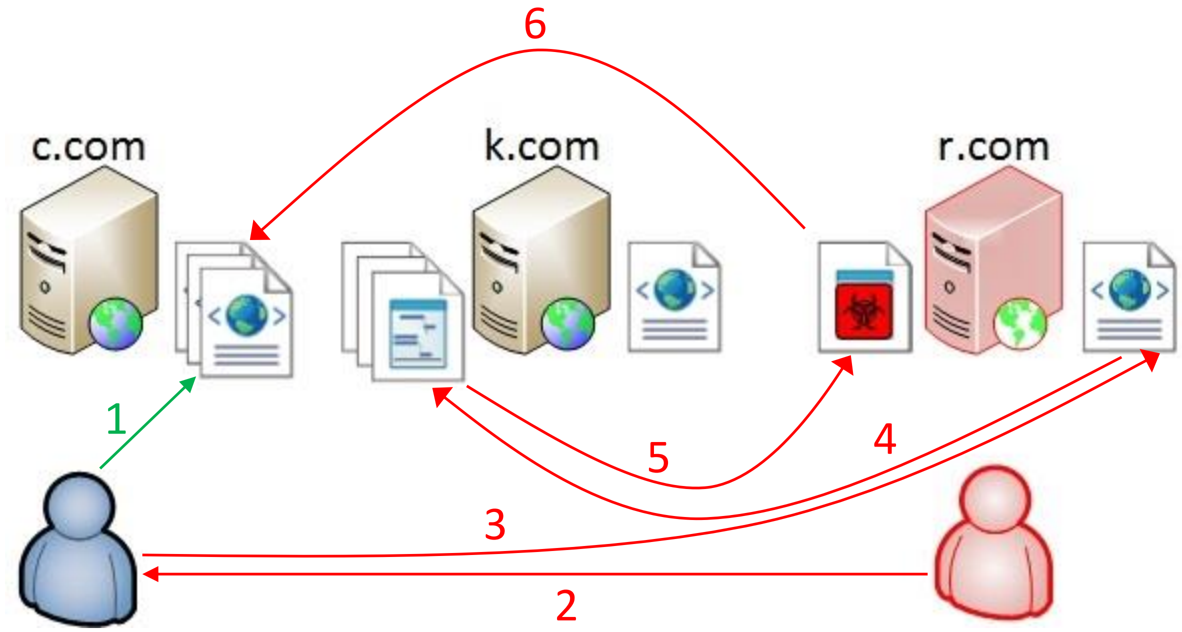
Common Vulnerabilities

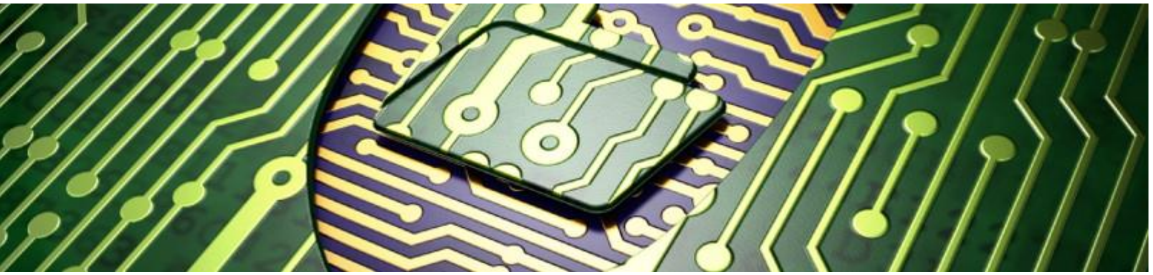
- Cross Site Flashing
  - Achieves the same as Cross Site Scripting
  - May run ActionScript code in the context of the vulnerable application
    - Implementation depended of the vulnerable application
    - Therefore, may have the same Security Sandbox

Common Vulnerabilities Demo I



Common Vulnerabilities Demo II





Questions?