The Executable Image Exploit

DEFCON XV

Michael Schrenk

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What you'll learn

- **What are the origins of this exploit.**
- What are the differences between "executable" and "Static" images?
- How to create images with PHP & GD
- How to fool servers into executing images (instead of serving them to browsers)
- How to do cool things with images on Web 2.0 websites

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What you won't learn

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- **This exploit works on images downloaded from servers**
- **This is not a client-side exploit.**
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`javascript image`

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Goals

- **To learn how program "executable images"**
- To learn where they can be applied
- To get you started on your own applications
- This is not a "code-heavy" presentation!

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Who's Schrenk?

- **Long-time webbot writer**
- 8th DEFCON, 3rd time speaker
- Minneapolis & Madras (Chennai)

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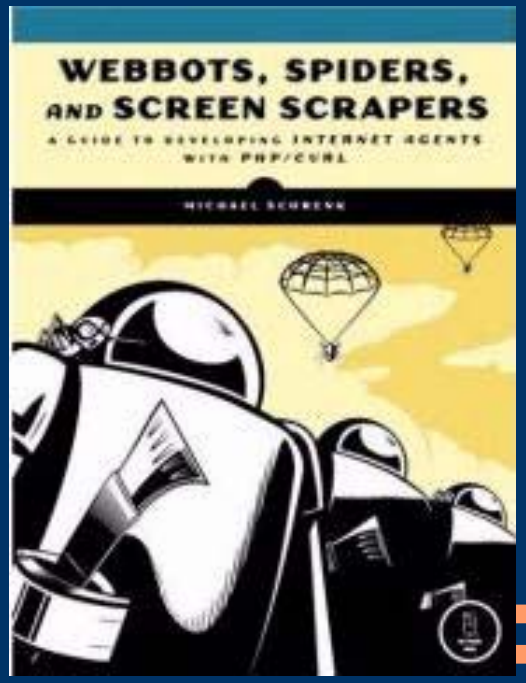

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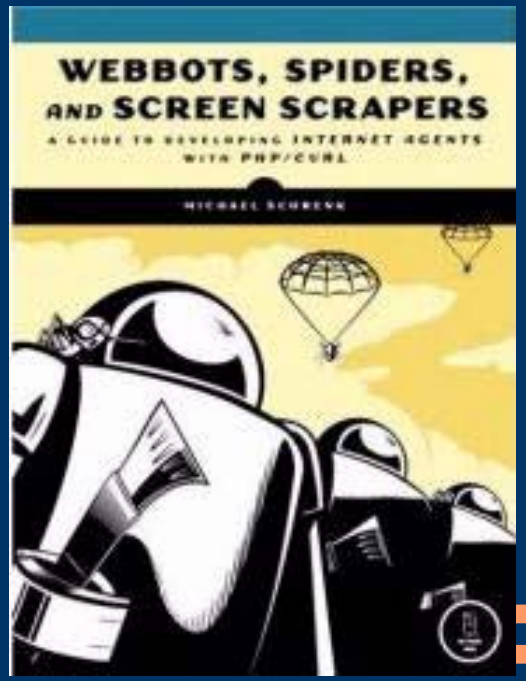

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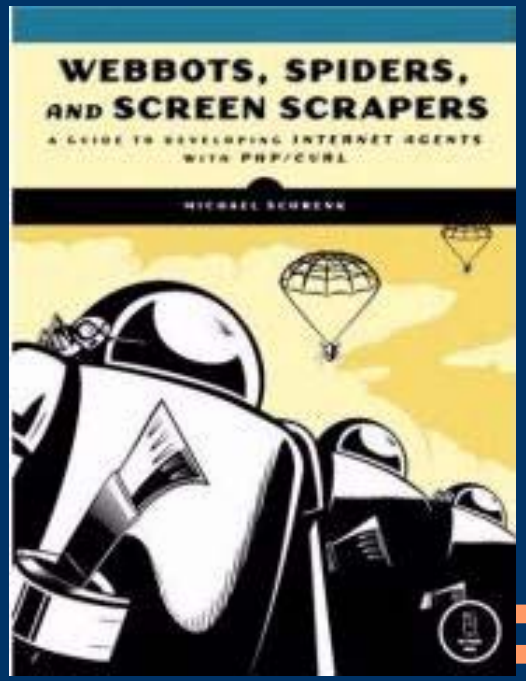

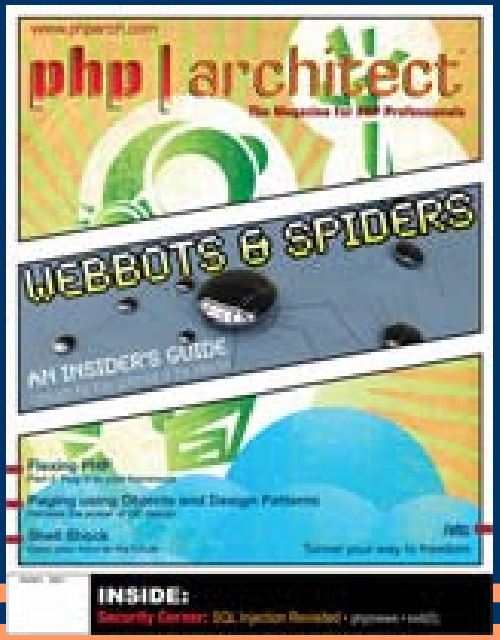

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Exploit Origins

- **To create a really good MySpace tracker.**
- Wanted to add image to “friends” pages that looks like this:

  `<IMG src=“image.php?im=test”>`
- Got frustrated because MySpace doesn’t allow such images.
- Most web 2.0 sites don’t

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- **MySpace won't allow you to reference images like `<IMG src="image.php?im=test">` because:**
  - **This is a program not actually an image**
  - It is a executable **image**
    - May still send an image to the browser
    - May also:
      - Write cookies
      - Track environment variables
      - Access databases, Send instant messages, etc

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What is a executable image?

- **Executable images are programs**
- Often used when images are stored in databases
- Can dynamically deliver “altered” images
  - Watermarks (with time stamp or IP addresses)
  - CAPTCHAs

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Executable image example #1

You can “pull” an image from a database with code like this

```
<IMG SRC=“show_img.php?id=34”>
```

```
<?php
# show_img.php
// Get image (blob) from database
include("mysql_library.php");
$id = $_GET['id'];
$sql = "select IMAGE from db_table where ID = '$id'";
$img = execute_sql($sql);

//Send image to the browser
header("Content-type: image/jpeg");
echo base64_decode($img);
exit;
?>
```

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- Image must be previously stored in database as a blob
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Executable image example #2

You can identify the image to display in a query string.

```
<img src="some_image.php?id=riviera.jpg">
```

Executable image example #2

```
<?php

// Create mime type for a  jpg image
header("Content-type: image/jpeg");

// Create an image handle from an actual JPG image
$im = imagecreatefromjpeg($_GET['id']);

// Create an image and send to browser
imagejpeg($im);

// Destroy the old image (no longer needed)
imagedestroy($im);

// Ensure file execution is over
exit;
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http://localhost/defcon/show_referenced.php?id=alexispark.jpg

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Why do this?

Because it's an executable program!

It mimics the actions of a real image

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Executable image example #3

```
// Create an image handle from an actual JPG image
$im = imagecreatefromjpeg( $_GET['id'] );
// Define font and font color
$font = 'arial.ttf';
$color = imagecolorallocate ($im, 255, 120, 0);
// Define executable content
$text = date("M d, Y h:m:s A", time());
$angle = rand(0, 90);
imagettftext($im, 20, $angle, 11, 301, $color, $font, $text);
// Create an image from the handle and send to browser
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Executable image example #3

Result of executable image #3

- Dynamic Example

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    - **Works across domains**

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    - Works across domains
  - Access databases
  - **Communicate via email, SMS, etc.**

Doing the dirty

```
// Create an image from the handle and send to browser
header("Content-type: image/jpeg");

// Write Cookie
setcookie("TestCookie", $value);

// Read Cookie
$old_cookie = $HTTP_COOKIE_VARS["TestCookie"];

// Get referer variable
$referer = $_SERVER['HTTP_REFERER'];

// Get query strings
$query_string = $_SERVER['QUERY_STRING'];

// Anything else

imagejpeg($im);
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MySpace doesn't allow them!

```
<IMG SRC="some_image.jpg">
```

```
<IMG SRC="some_image.php">
```

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Fooling apache to execute .JPGs

In the .htaccess file

```
AddType application/x-httpd-php .jpg
```

Tells apache to parse all files (in this or subsequent directories) with the .jpg extension as though they were PHP scripts!

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Fooling apache to execute .JPGs

Once done, you can reference your executable images like this…

```
<img src="www.yourdomain.com/image.jpg">
```

Example: Dynamic JPG

Applications

Can be used on many (web 2.0) websites that let you post comments.

- **Craigs List**
- **Ebay**
- **MySpace**
- **Fark**
- **PayPal (payment page)**

Also on non-web environments

- **Newsgroups (NNTP)**
- **Email**

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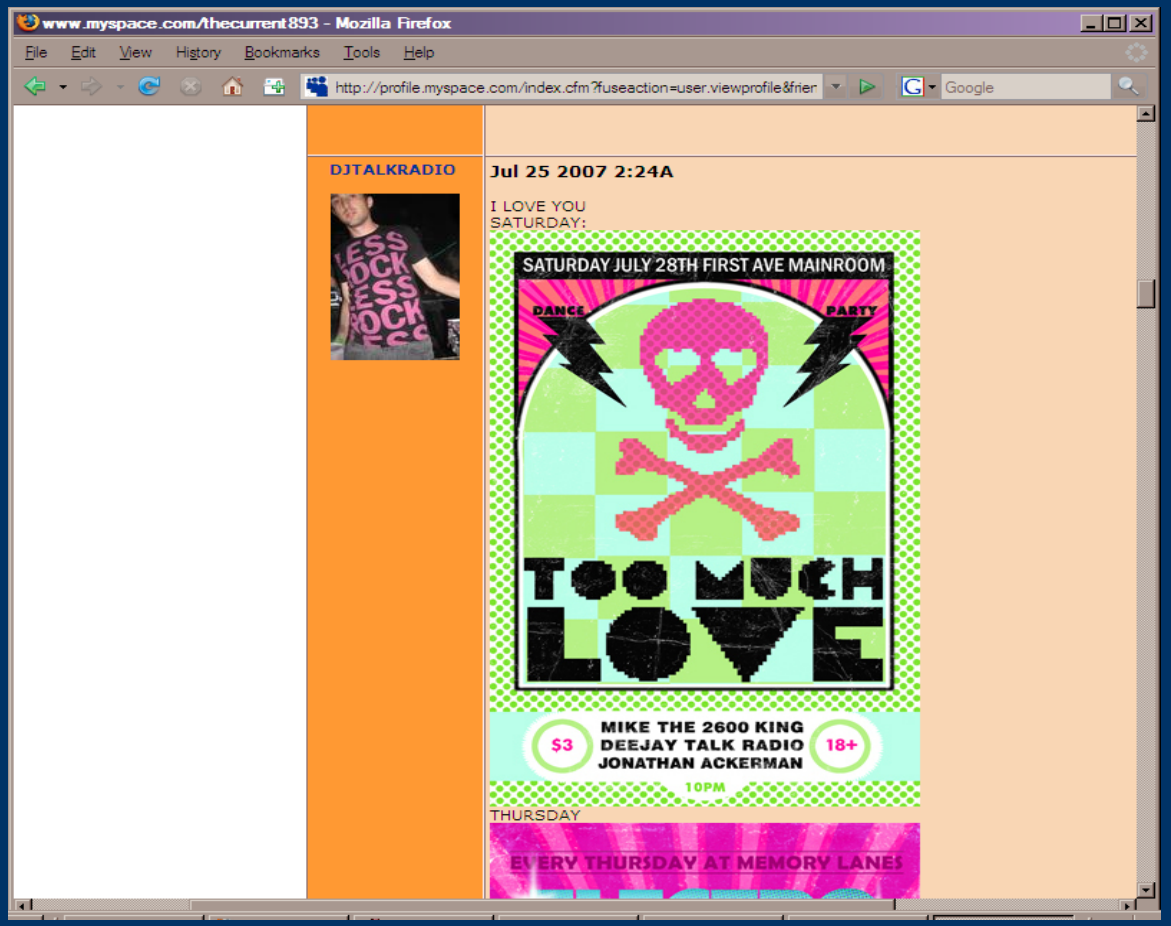
Tracking people on MySpace

Add an inline (executable) image in a MySpace comment



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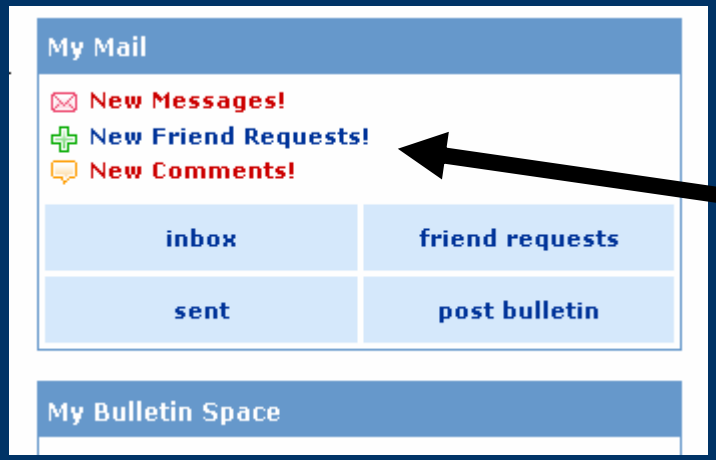

When one checks new messages or new comments

and the comment/message contains a executable image…

The userID is in $_SERVER['HTTP_REFERER'];

Tracking people on MySpace

The userID lets you associate a cookie with their identity:

`http://profile.myspace.com/index.cfm?fuseaction=user.viewprofile&friendid=`***`userID`***

Anytime they revisit, you can track them.

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Other MySpace fun

You can write an application that shows the viewing habits of all your friends by sending them each a message that contains a executable image.

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Other MySpace fun

You can show one set of pictures to your MySpace friends, and another to set of images to non-friends.

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Other MySpace fun

You can use these same cookies to track people's movement on other sites (eBay, Craigslist, etc).

Since your cookies all belong to the domain that your executable image is on, your cookies will "appear" to function across domains.

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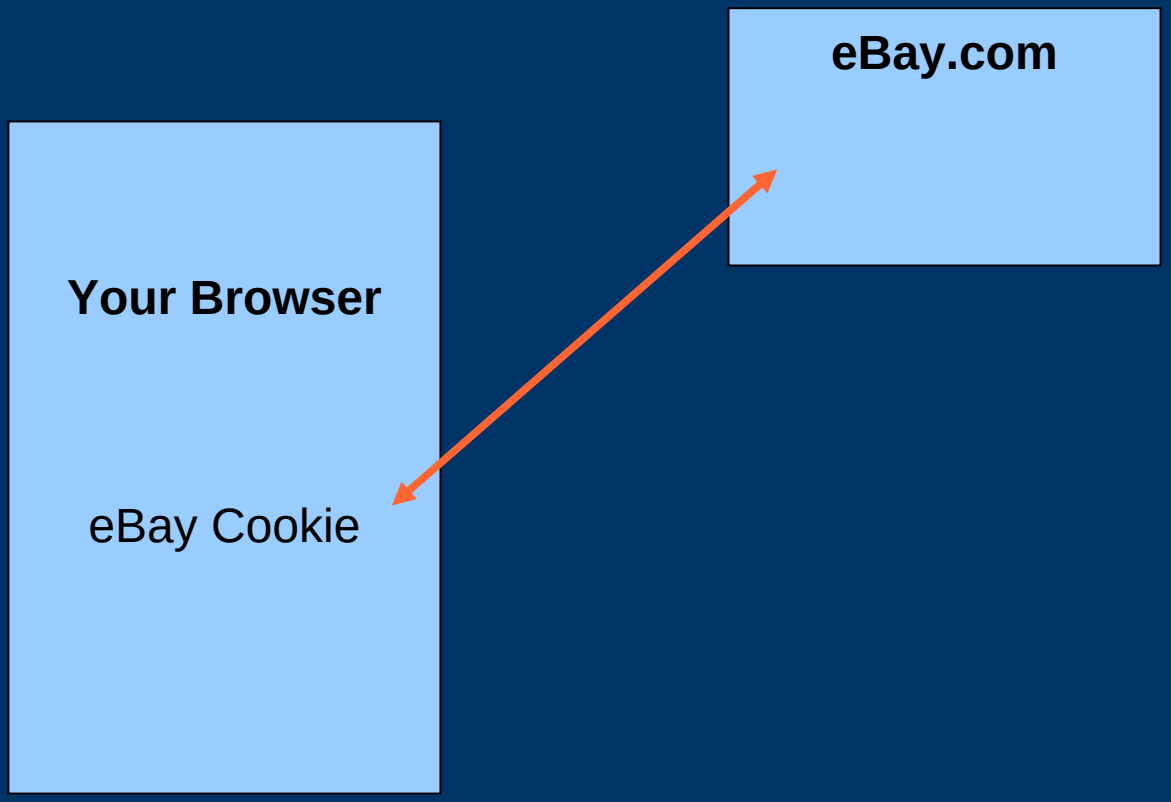
Spanning domains



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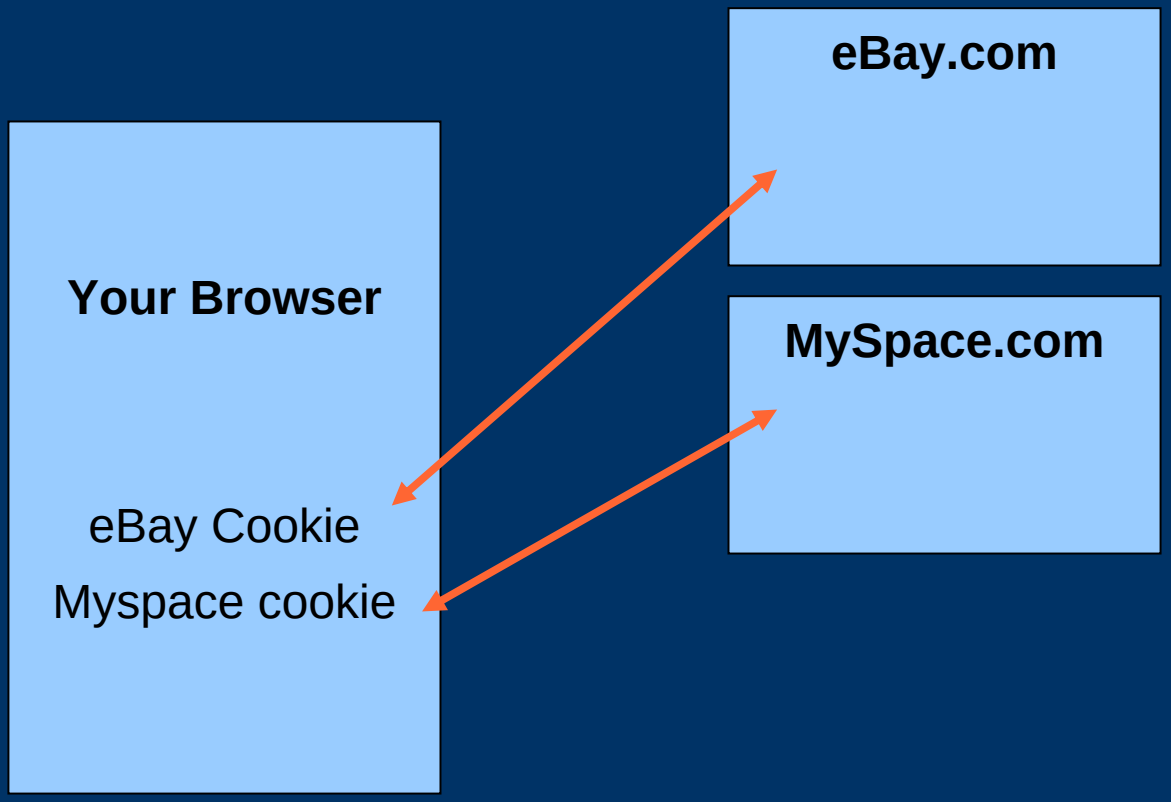

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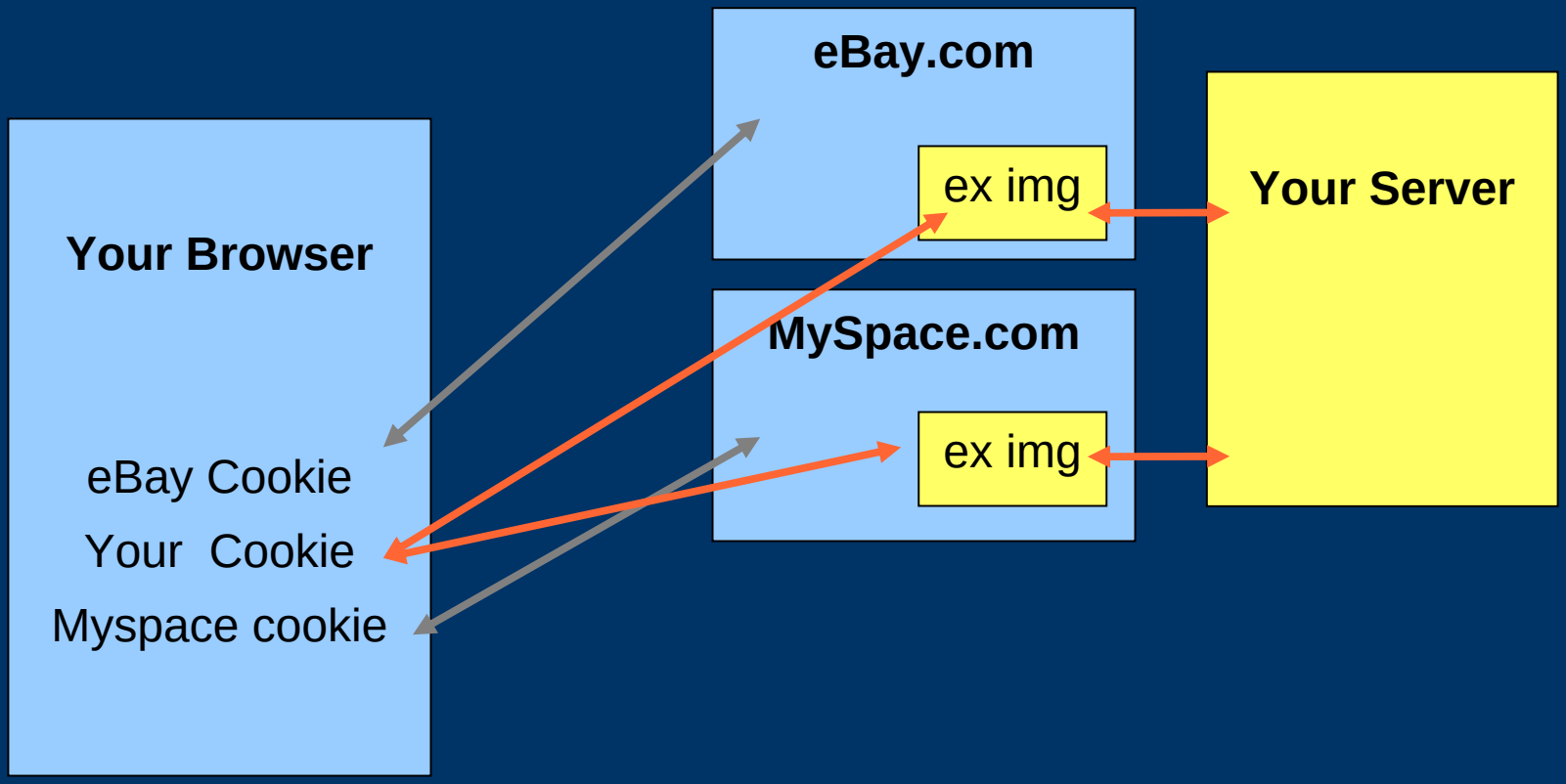
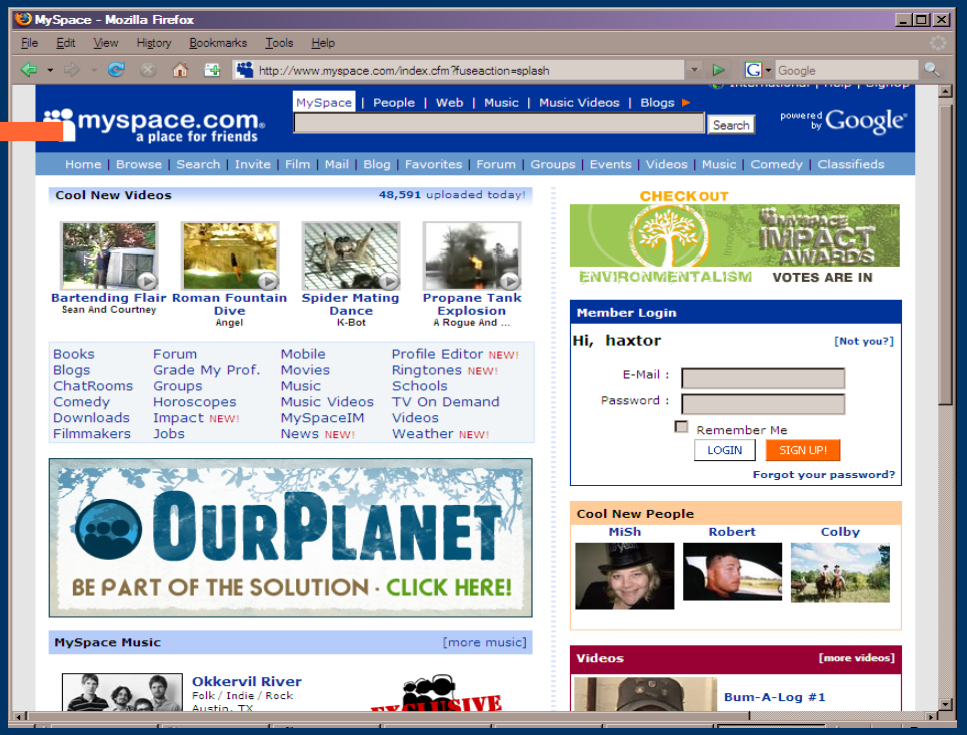
Spanning domains



Third Party Cookies

First party cookie



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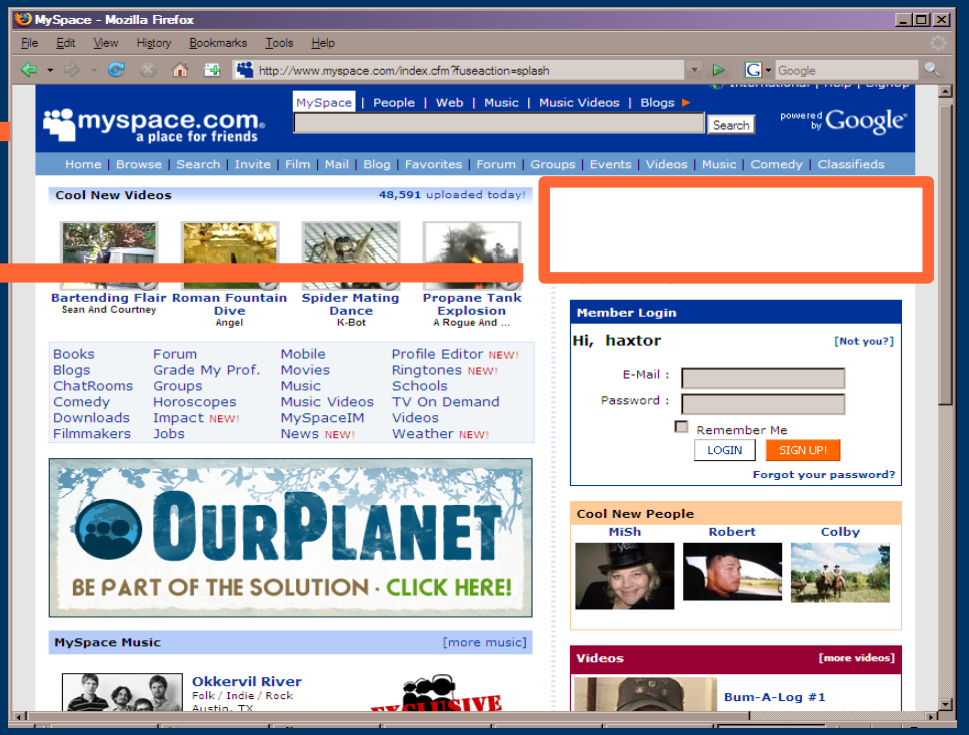

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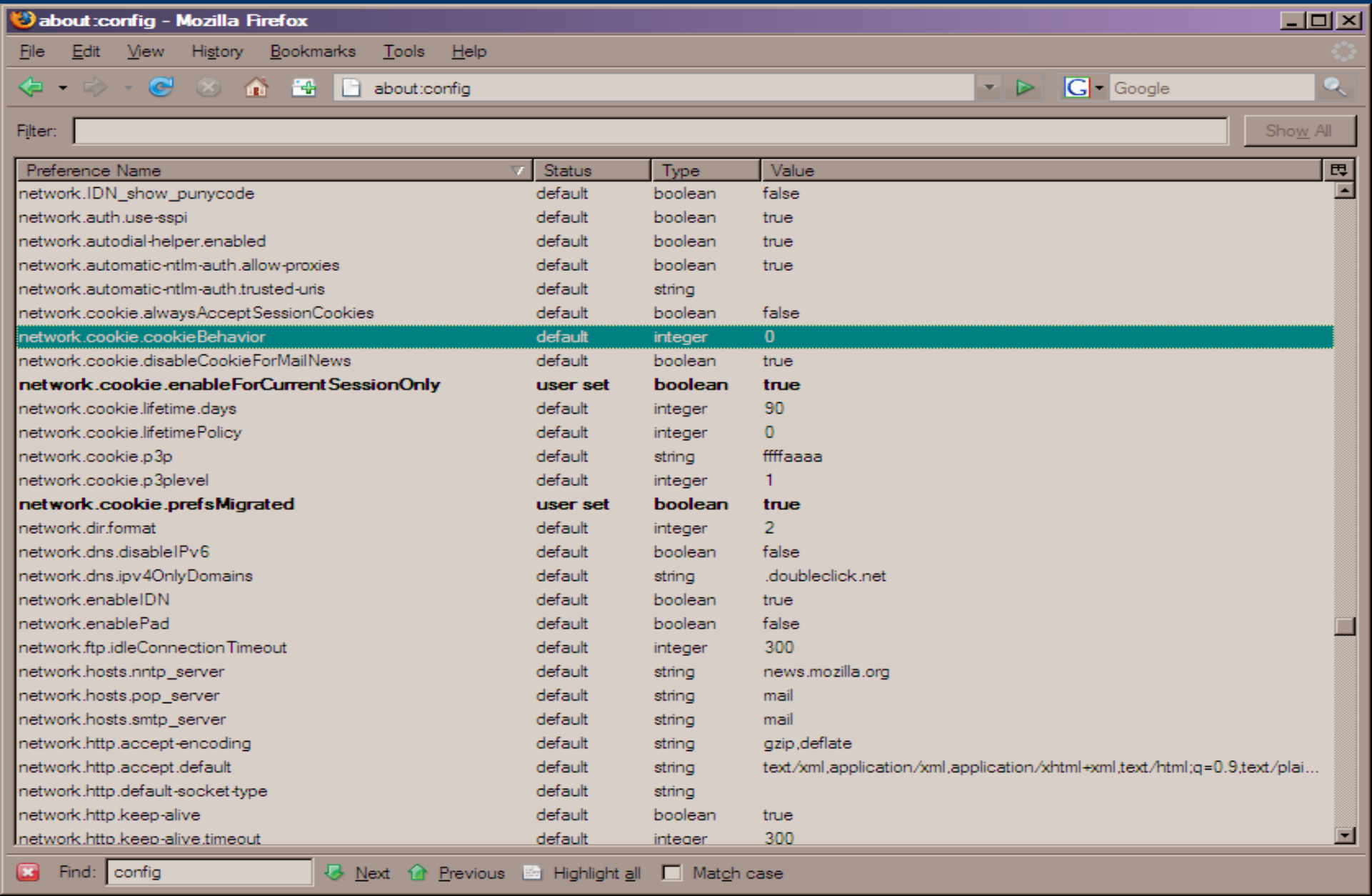

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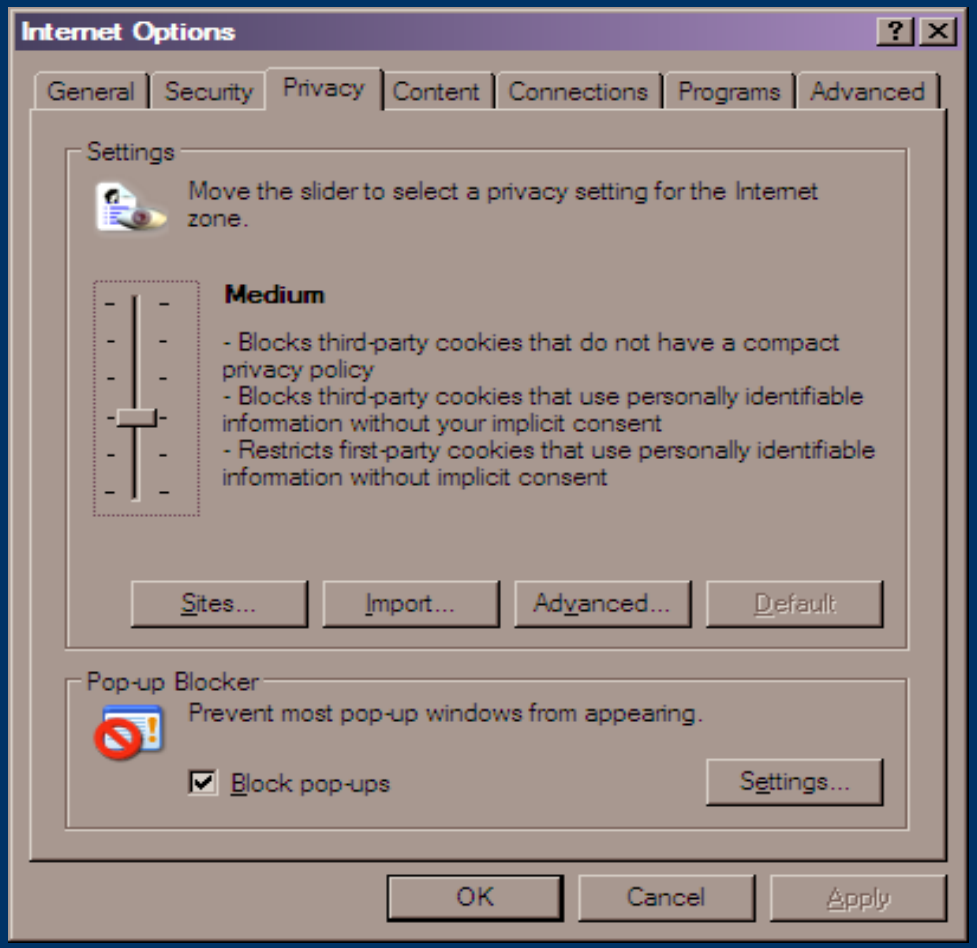


```
<?php
header("P3P: policyref=\"http://www.yourDomain.com/w3c/p3p.xml\", CP=\"CAO DSP COR\"");
?>
```

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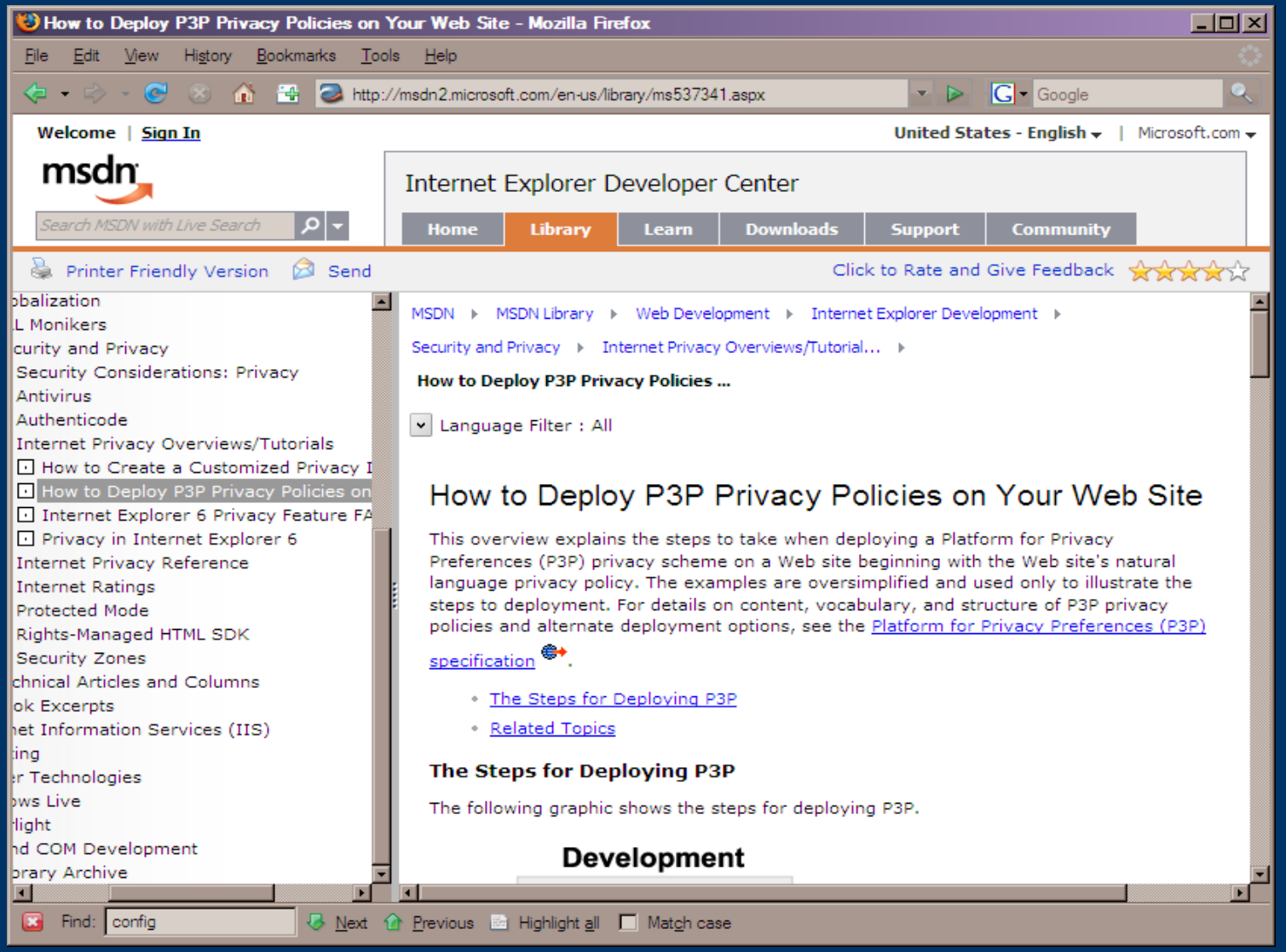

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Other Web 2.0 Fun

Show high quality images to members of your site and poor quality images to everyone else

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Other Web 2.0 Fun

Embed identifying watermarks in images to track unauthorized use

Other Web 2.0 Fun

Create eBay auctions with images that change as you near the end of the auction

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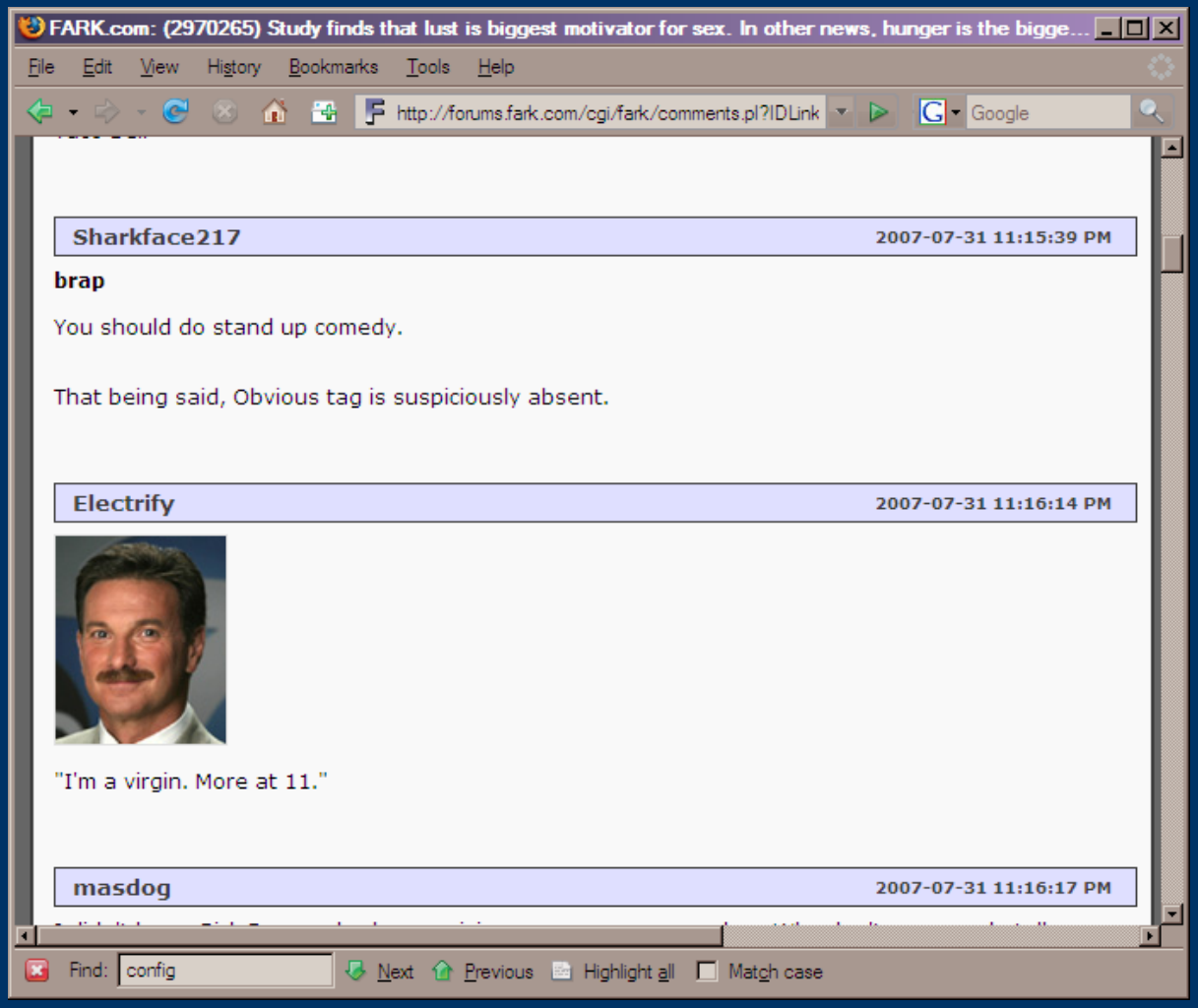
Other Web 2.0 Fun

Show different images in your eBay auction after people see your similar ad on Craigs List

Other Web 2.0 Fun

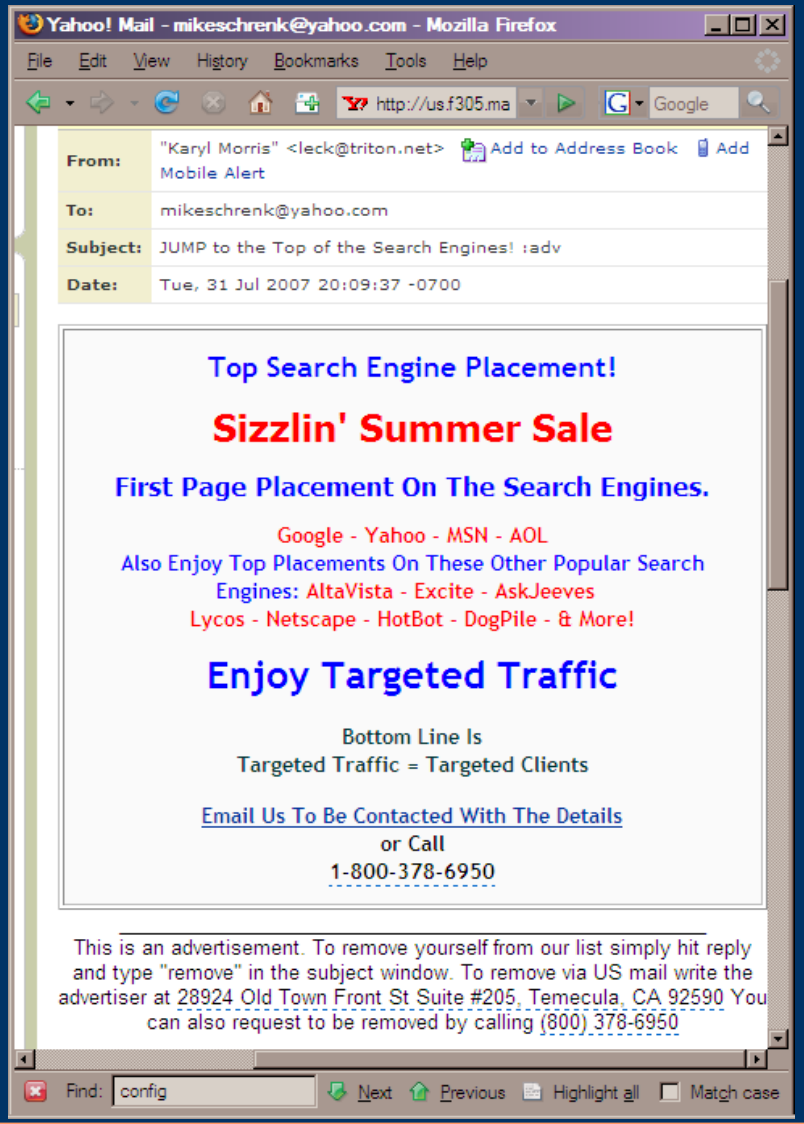
Evaluate websites you want to advertise on



Other Web 2.0 Fun

Receive an acknowledgement when an email is read

nonrepudiation



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Other Web 2.0 Fun

Develop images with expiration dates

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Getting ideas

Focus on applications where images can be loaded from your server (think across domains)

Use:

- **Cookies**
- **Referrer variables to catch query strings**

Images are easy to manipulate with PHP & GD

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Defences

Watch what you put in query strings

- **Sessions may be stolen if all of the session variable is in a query string**

Allow people to upload images instead of referencing them

- **Takes more server space & bandwidth**
- **Removes the “executable” from images.**

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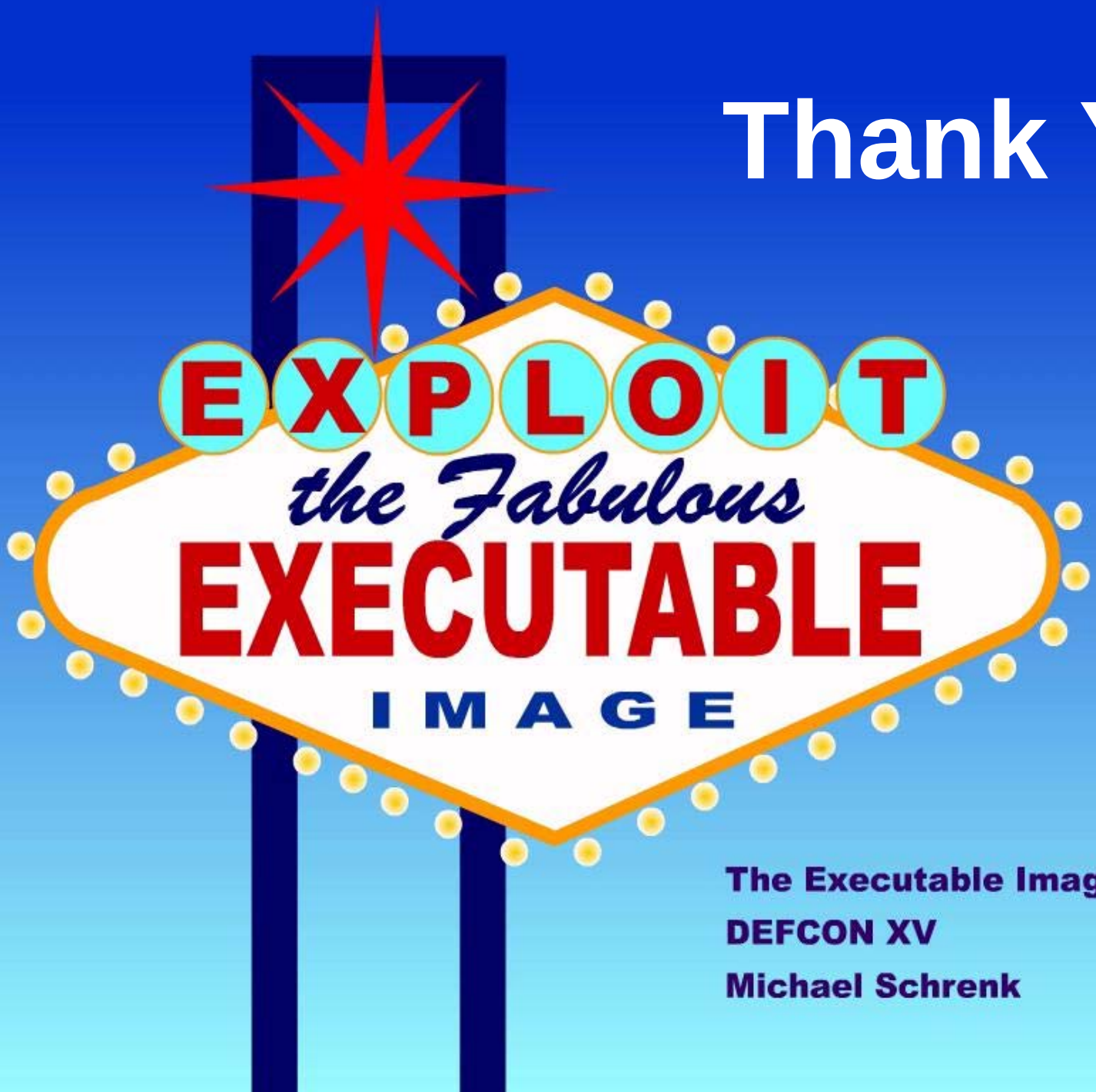
Thank You!



The Executable Image Exploit

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Michael Schrenk