
SCREEN
SCRAPER
TRICKS
DIFFICULT
CASES
GOLDEN
NUGGET
GAMBLING HALL
HOTEL
DEFCON
GOLDEN
NUGGET
Eldorado CLUB

DEFCON XVII July 31-Aug 2, 2009
Screen Scraper Tricks: Difficult cases

Las Vegas, Nevada
mike@schrenk.com

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Review Basic SCREEN SCRAPER THEORY

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Define what
Constitutes a
"DIFFICULT CASE"

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Demo some

"SCREEN SCRAPER TRICKS"

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Look at ideas for
LARGE-SCALE
DEPLOYMENT

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Share a
HEARTWARMING
MOMENT
Featuring
CAPTCHAs!

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Goals of this Talk

Gain an understanding of some unusual (useful) web scraping techniques

Your not going to walk away form here with ready-made solutions

The goal is to expose you to some new ideas that you can apply to your specific situation

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- For the purposes of this discussion, the solutions have to meet three criteria:

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  - #2. Free *(or Open Source)*

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Technologies & Tools Discussed

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  - #2. Free *(or Open Source)*
  - #3. Platform independent

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BIO:

Michael Schrenk

- Minneapolis-based bot writer, consultant & author

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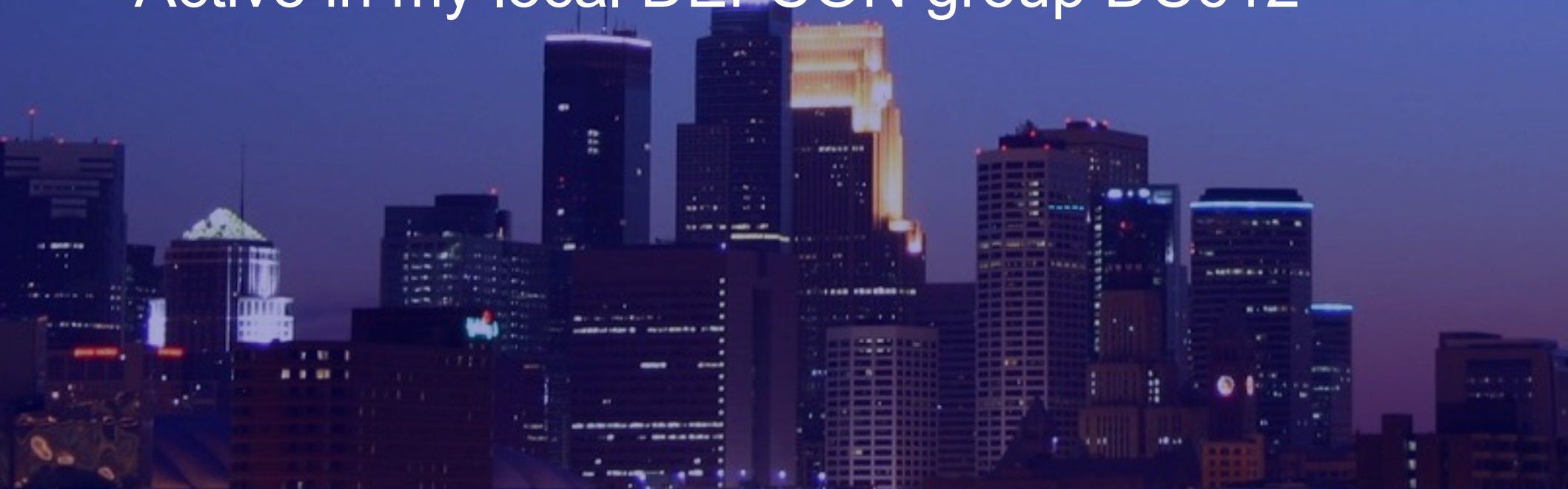
- Active in my local DEFCON group DC612



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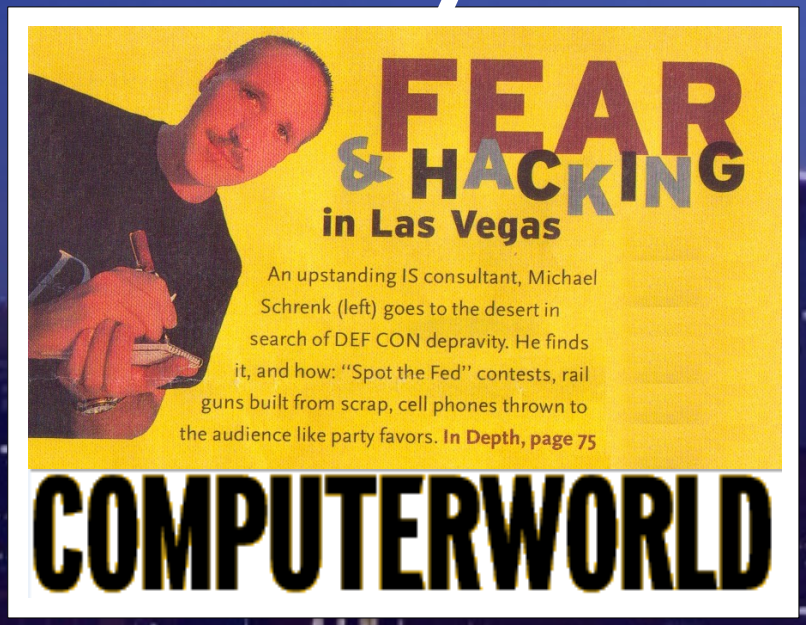
BIO:

My DEFCON History

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17



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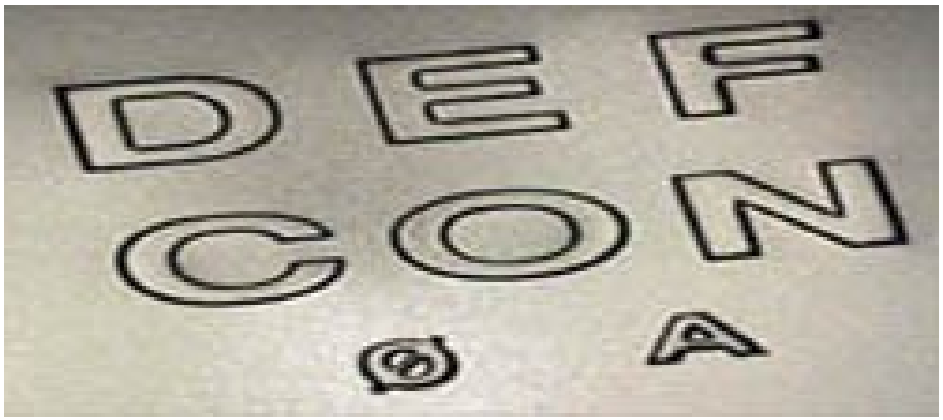

Talk:
Introduction to Writing Spiders & Agents

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BIO:

My DEFCON History

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Talk:
Online Corporate Intelligence

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BIO:

My DEFCON History

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Talk:

The Fabulous Executable Image Exploit

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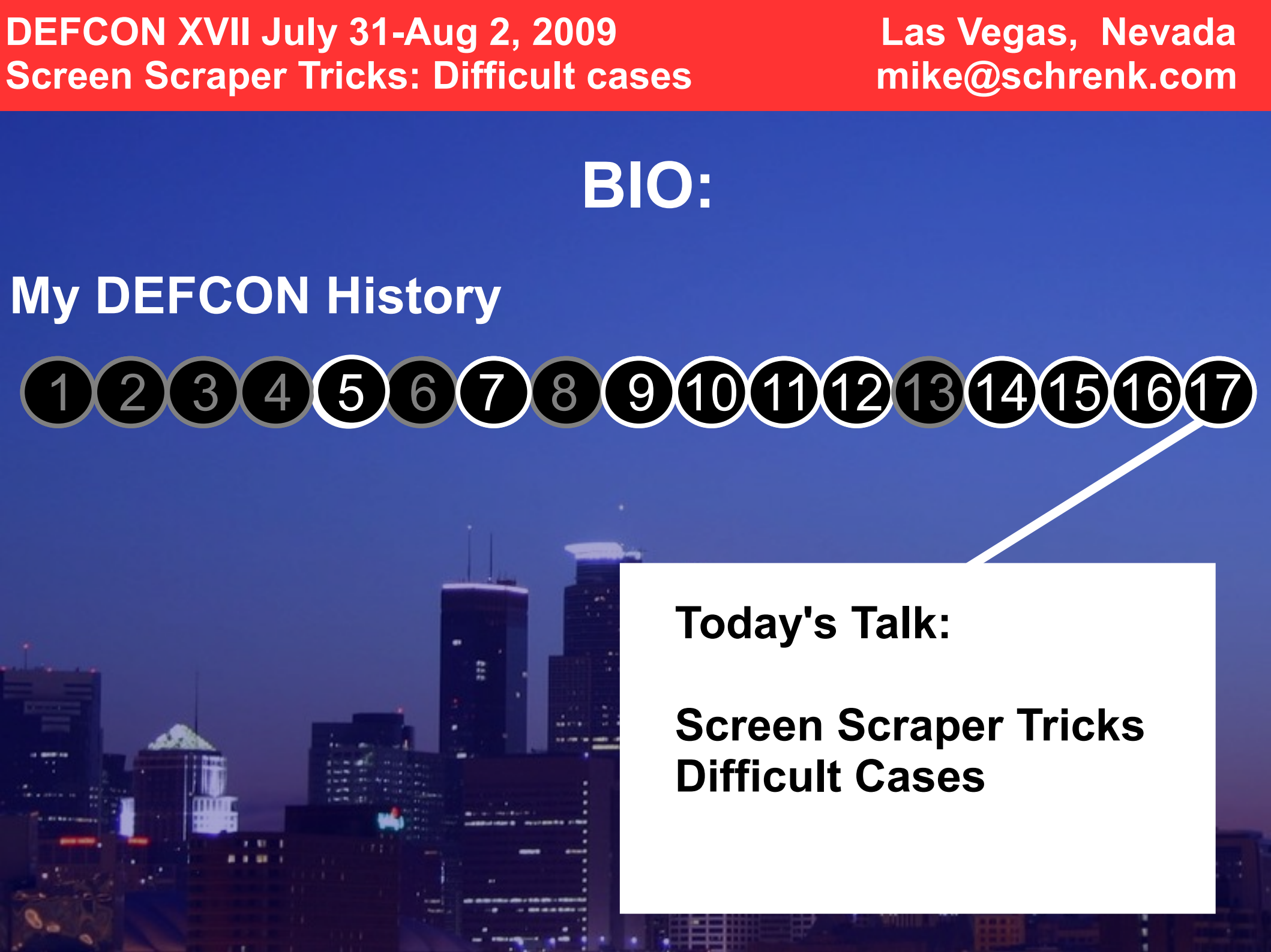

Today's Talk:

Screen Scraper Tricks
Difficult Cases

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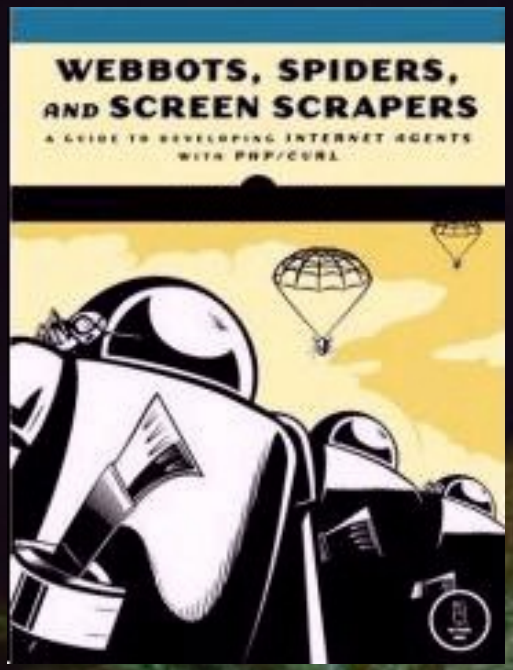
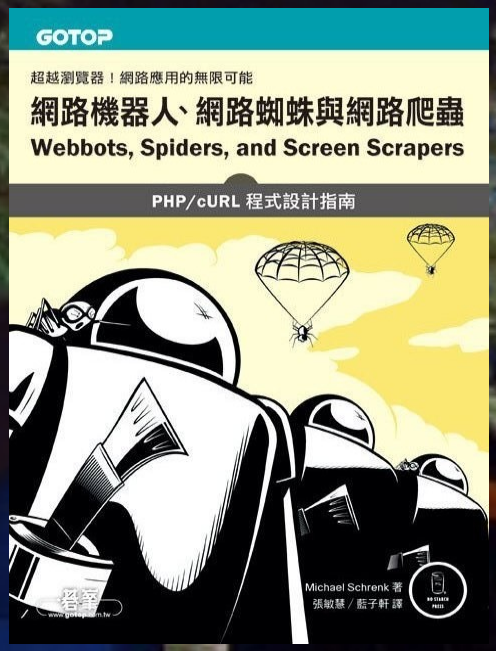


My book

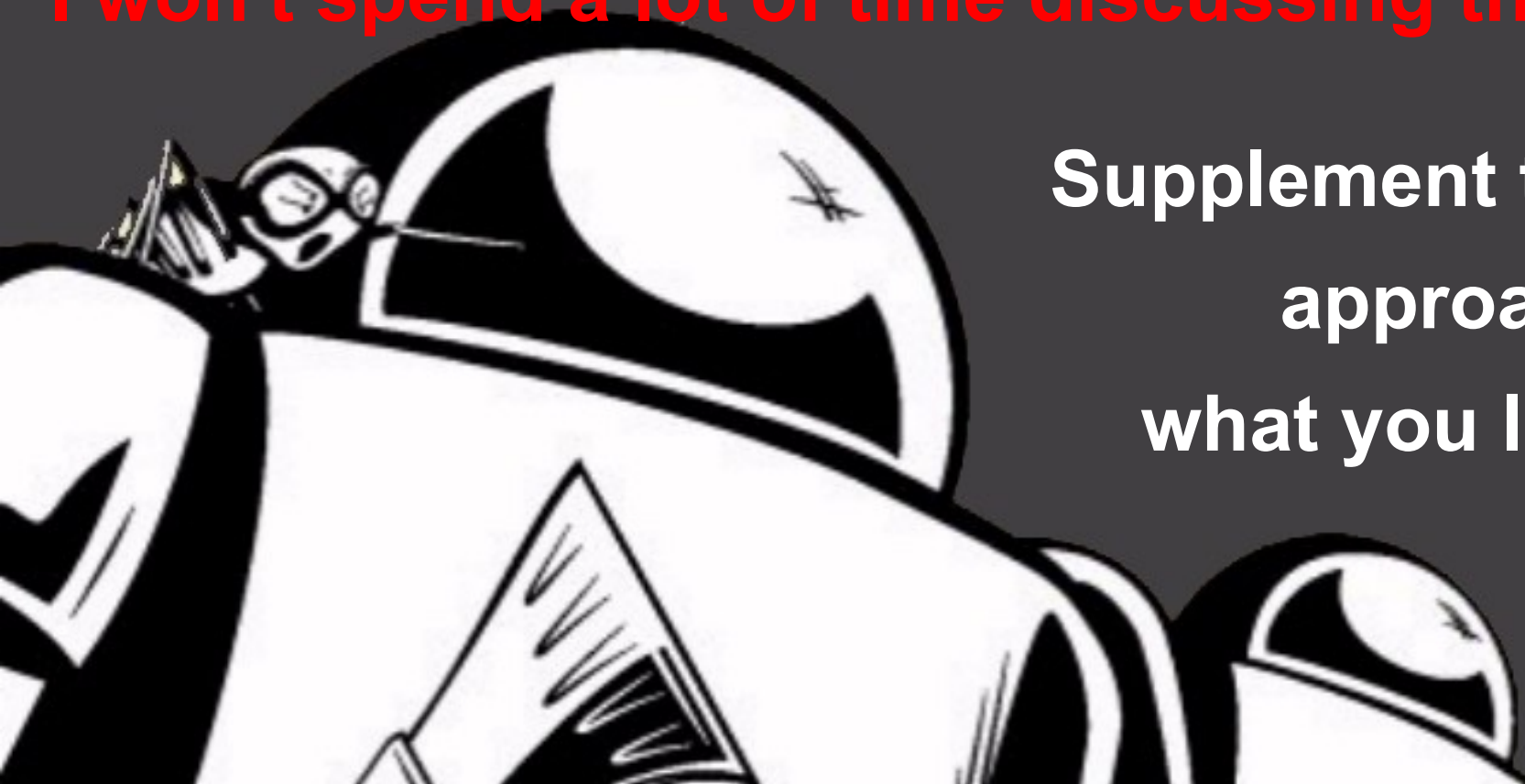
2007, No Starch Press
San Francisco



Traditional strategies not obsolete

- Downloading, Parsing, Form submission
- Authentication, Stealth, Fault tolerance, etc.

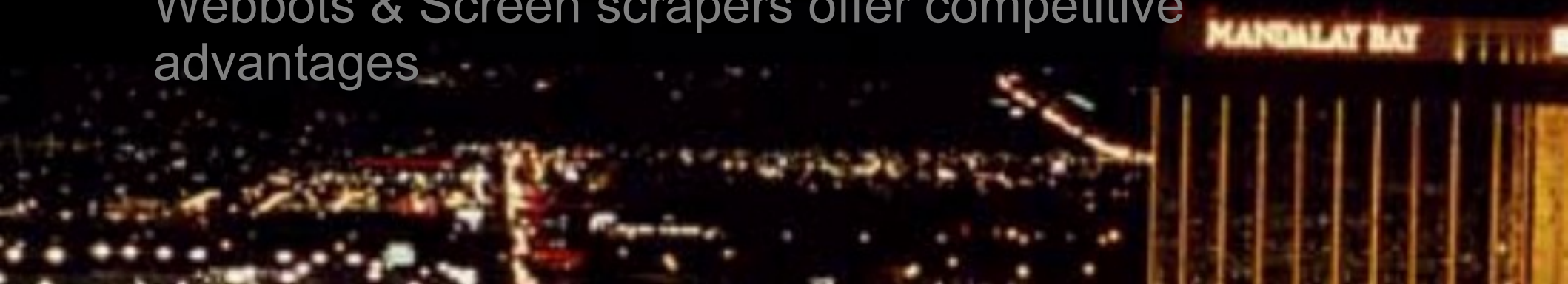
I won't spend a lot of time discussing these things



Supplement traditional approaches with what you learn today

Why are Screen Scrapers Important?

- Browsers (alone) are deficient
  - Browsers are manual, error prone & time consuming tools
  - Browsers do not make decisions for you
  - Browsers are not proactive
- You won't excel by just doing what everyone else does
  - Webbots & Screen scrapers offer competitive advantages



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Review of traditional screen scraping

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Review of traditional screen scraping

- Download a web page

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Review of traditional screen scraping

- Download a web page
  - Manage cookies

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Review of traditional screen scraping

- Download a web page
  - Manage cookies
  - Facilitate (SSL) encryption

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Review of traditional screen scraping

- Download a web page
  - Manage cookies
  - Facilitate (SSL) encryption
  - Handle server redirection

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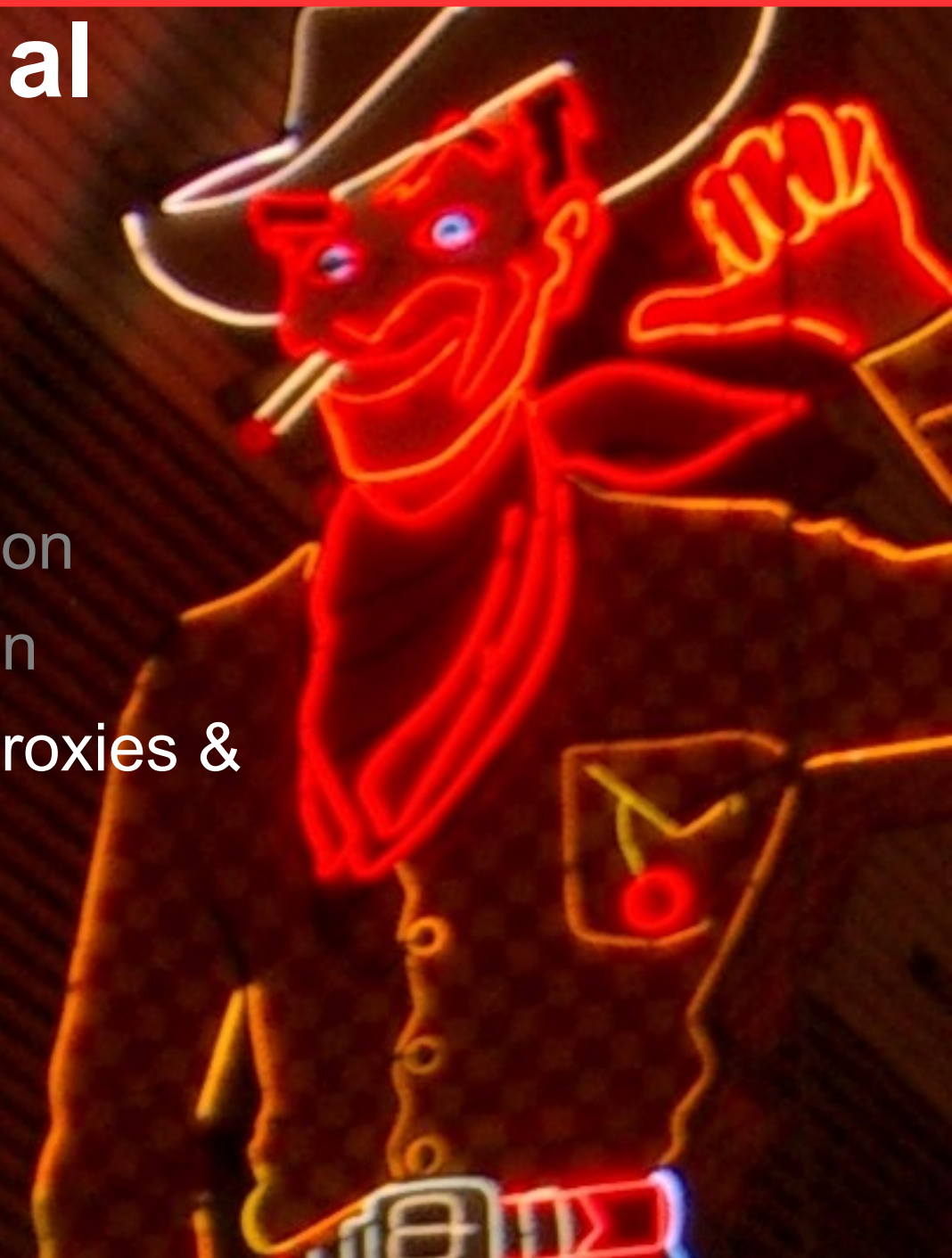
Review of traditional screen scraping

- Download a web page
  - Manage cookies
  - Facilitate (SSL) encryption
  - Handle server redirection
  - Hide your identity with proxies & random timing



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Review of traditional screen scraping

- Download a web page
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- Emulate form submission

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Review of traditional screen scraping

- Download a web page
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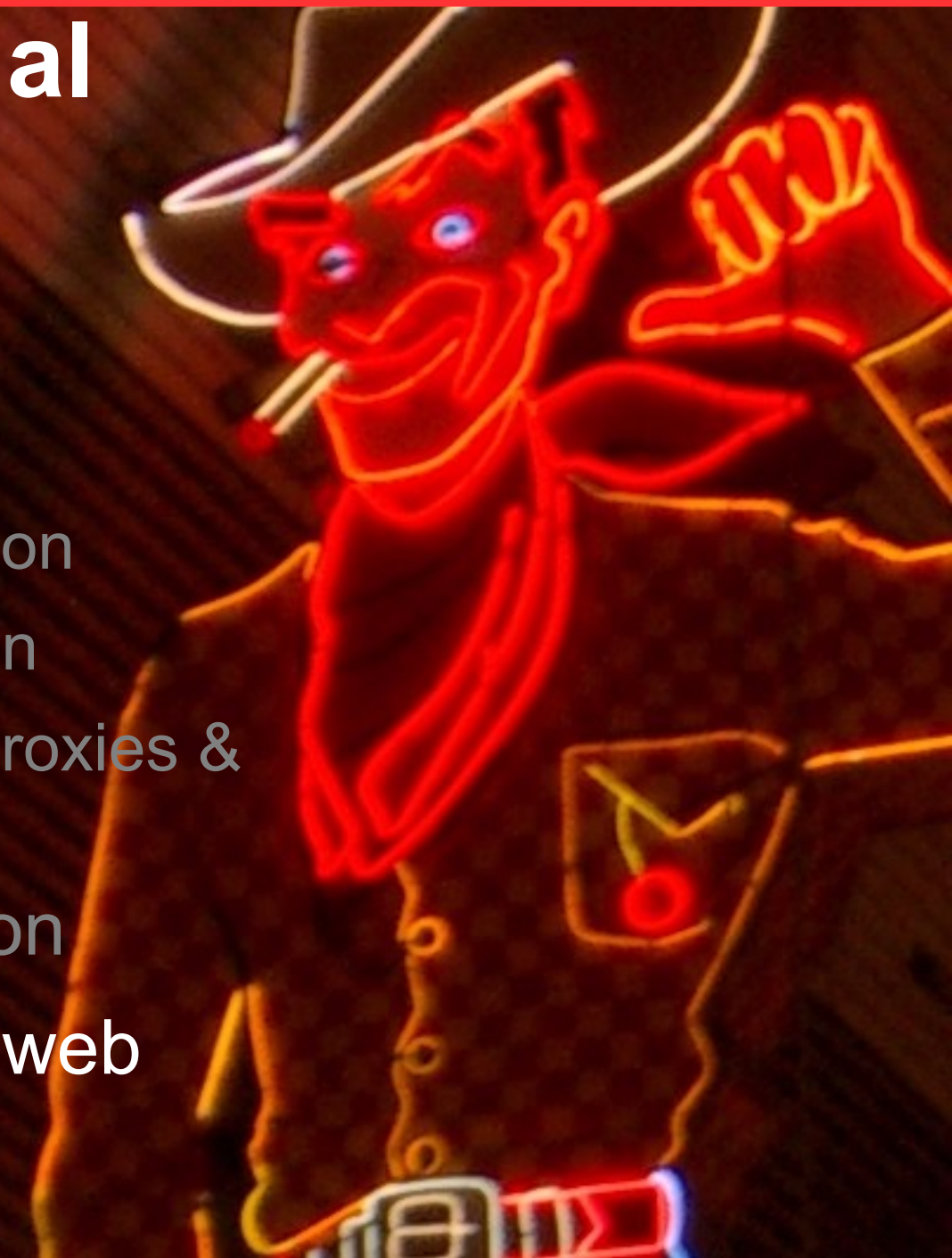
- Emulate form submission
- Parse information from web pages & take action



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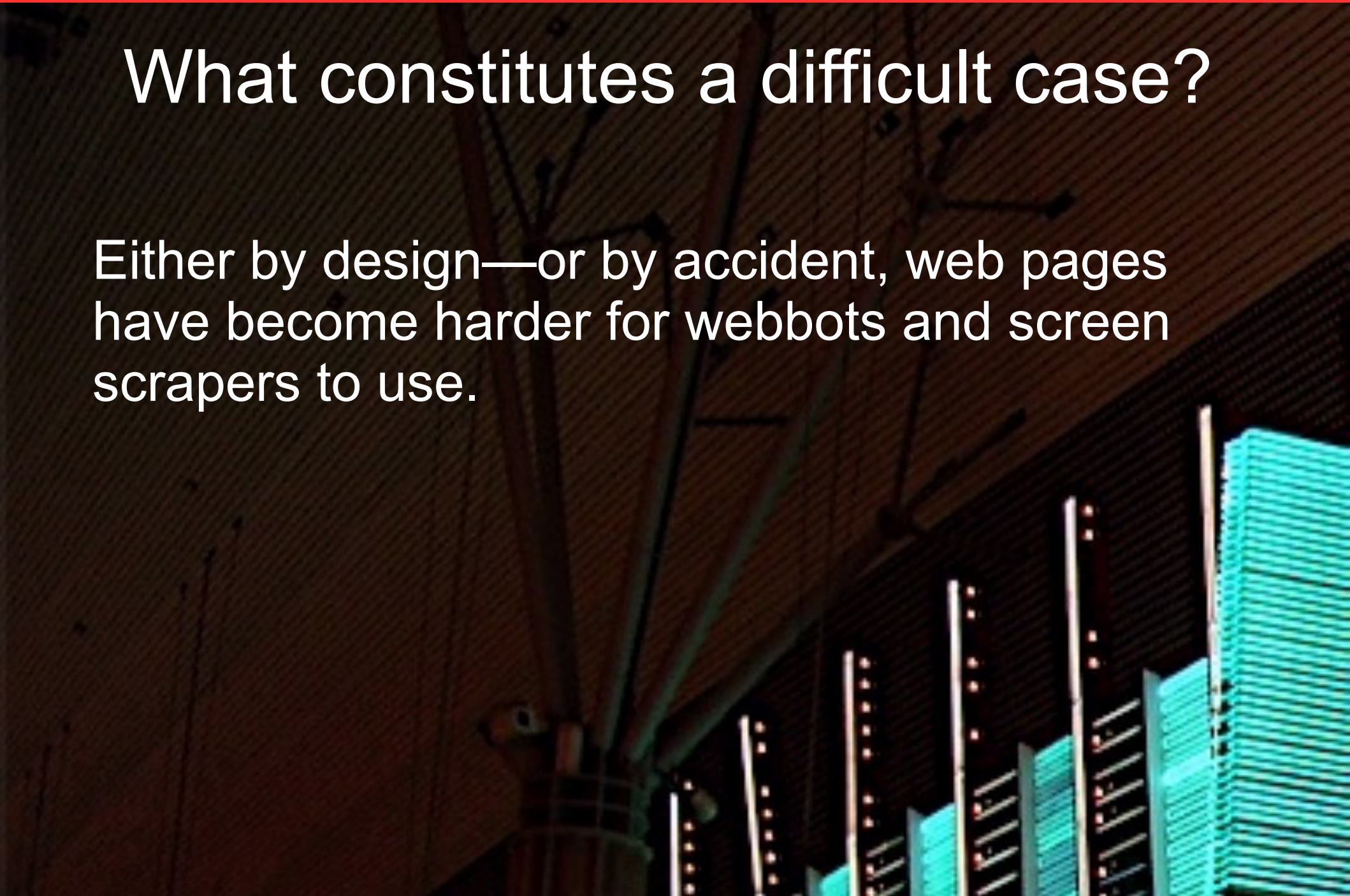
FREE DOWNLOAD

These tasks *(except proxy functions)*
can be coded with the free
PHP code libraries from my book

http://www.schrenk.com/nostarch/webbots/DSP_download.php

What constitutes a difficult case?

Either by design—or by accident, web pages have become harder for webbots and screen scrapers to use.



What constitutes a difficult case?

Interstitial web pages

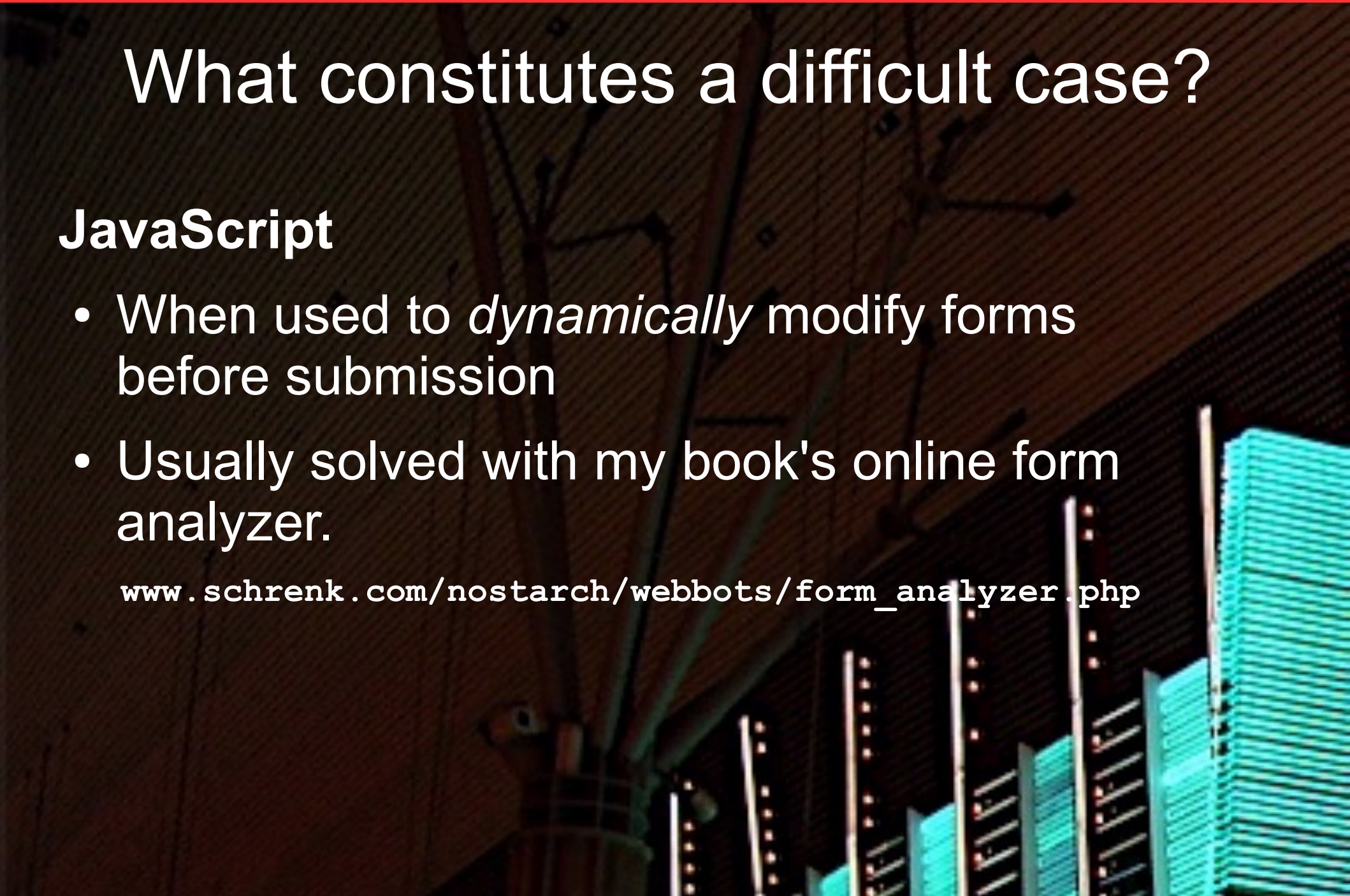
- Commonly used by travel sites when there is a long delay between a database query and a result set.

What constitutes a difficult case?

JavaScript

- When used to *dynamically* modify forms before submission
- Usually solved with my book's online form analyzer.

`www.schrenk.com/nostarch/webbots/form_analyzer.php`



What constitutes a difficult case?

JavaScript

- AJAX used to populate pages

  Example: 

  You cannot do a “view source” after first page of search results

What constitutes a difficult case?

Flash

- When used as a navigation technique.

DHTML

- When used as a navigation technique

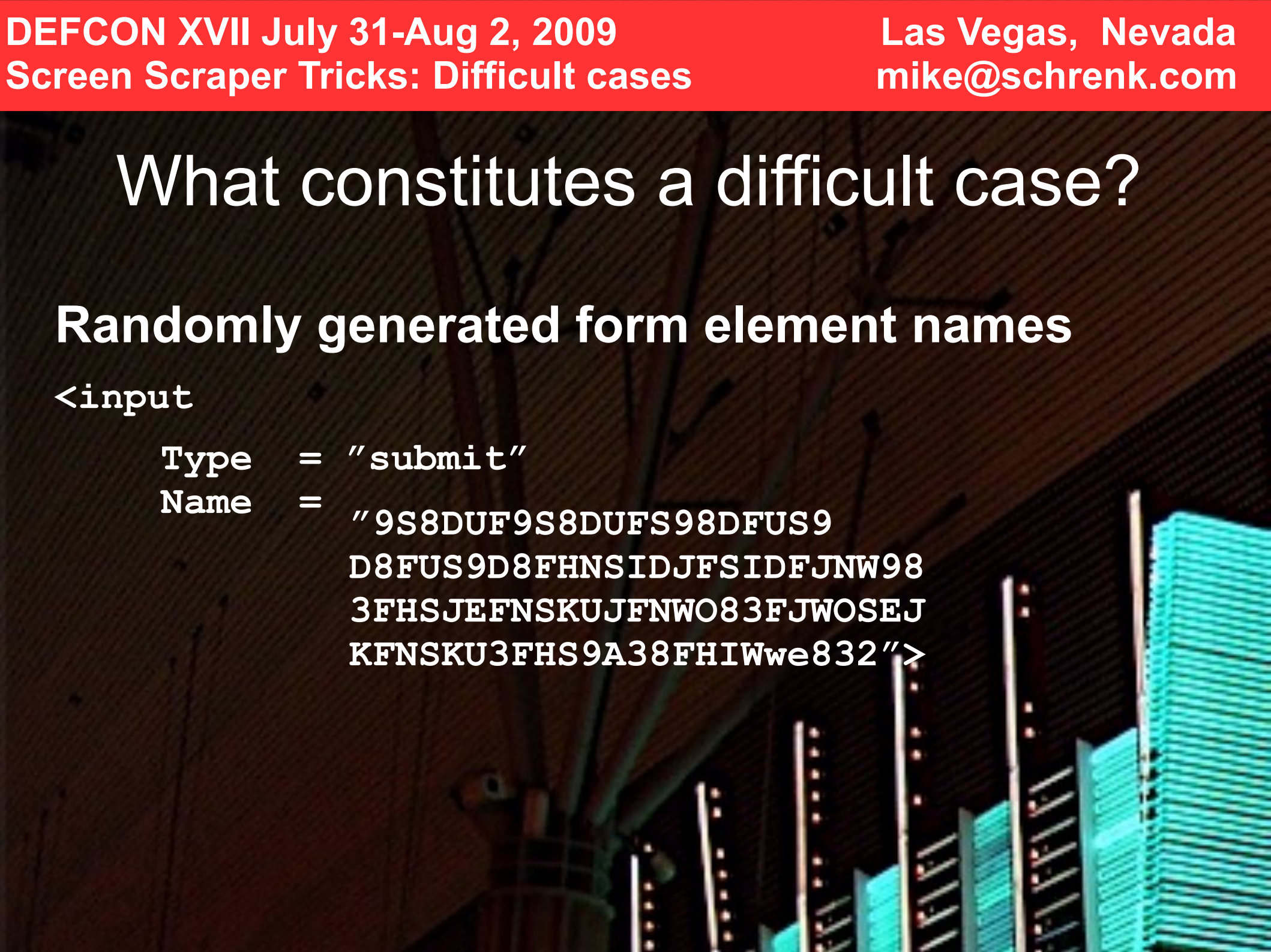
Elaborate cookie behavior

- Sequence dependent cookies
- Strange JavaScript scripts

What constitutes a difficult case?

Randomly generated form element names

```
<input
      Type   = "submit"
      Name   =
               "9S8DUF9S8DUFS98DFUS9
               D8FUS9D8FHNSIDJFSIDFJNW98
               3FHSJEFNSKUJFNWO83FJWOSEJ
               KFNSKU3FHS9A38FHIWwe832">
```



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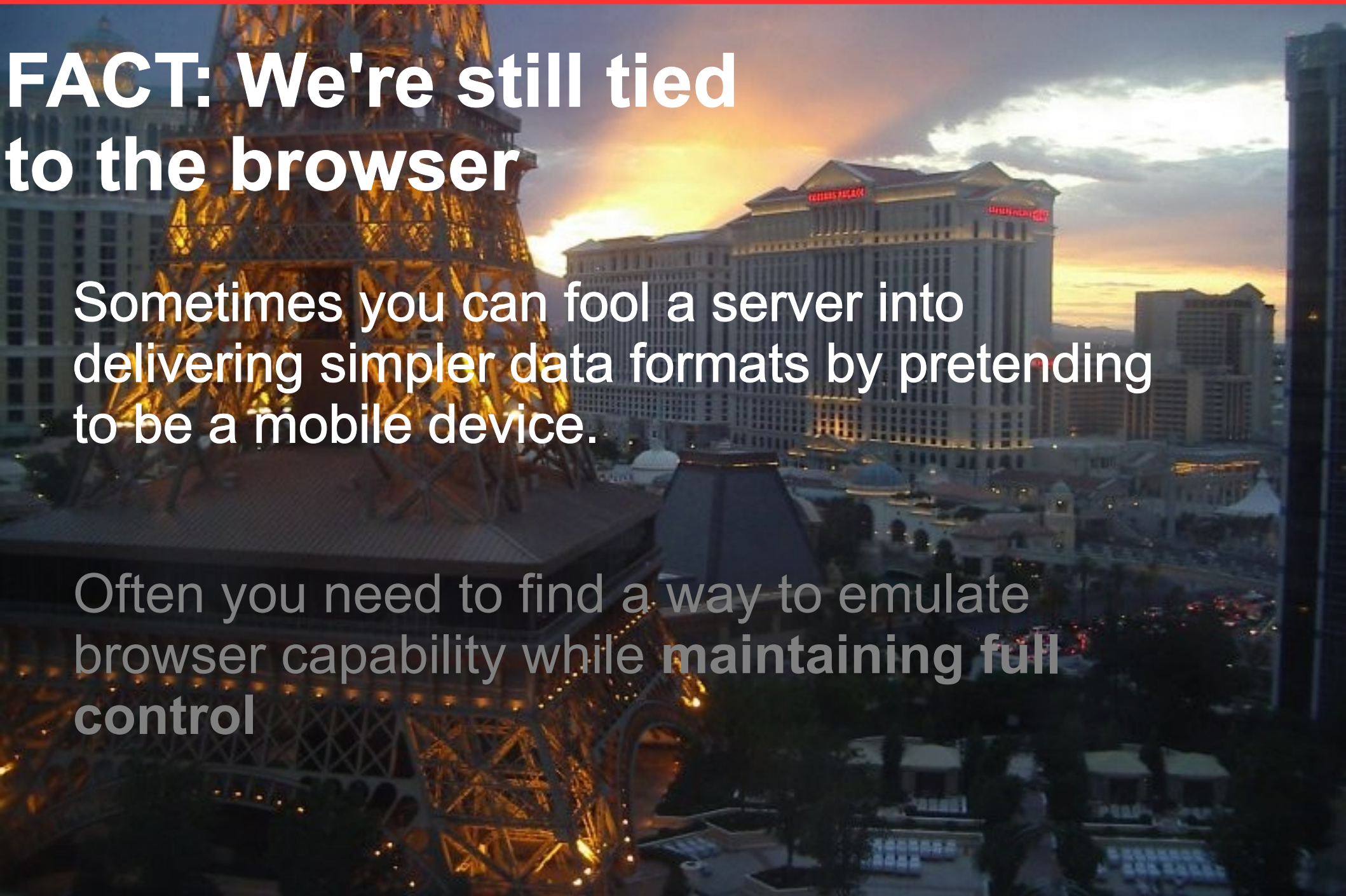

FACT: We're still tied to the browser

Sometimes you can fool a server into delivering simpler data formats by pretending to be a mobile device.

Often you need to find a way to emulate browser capability while **maintaining full control**

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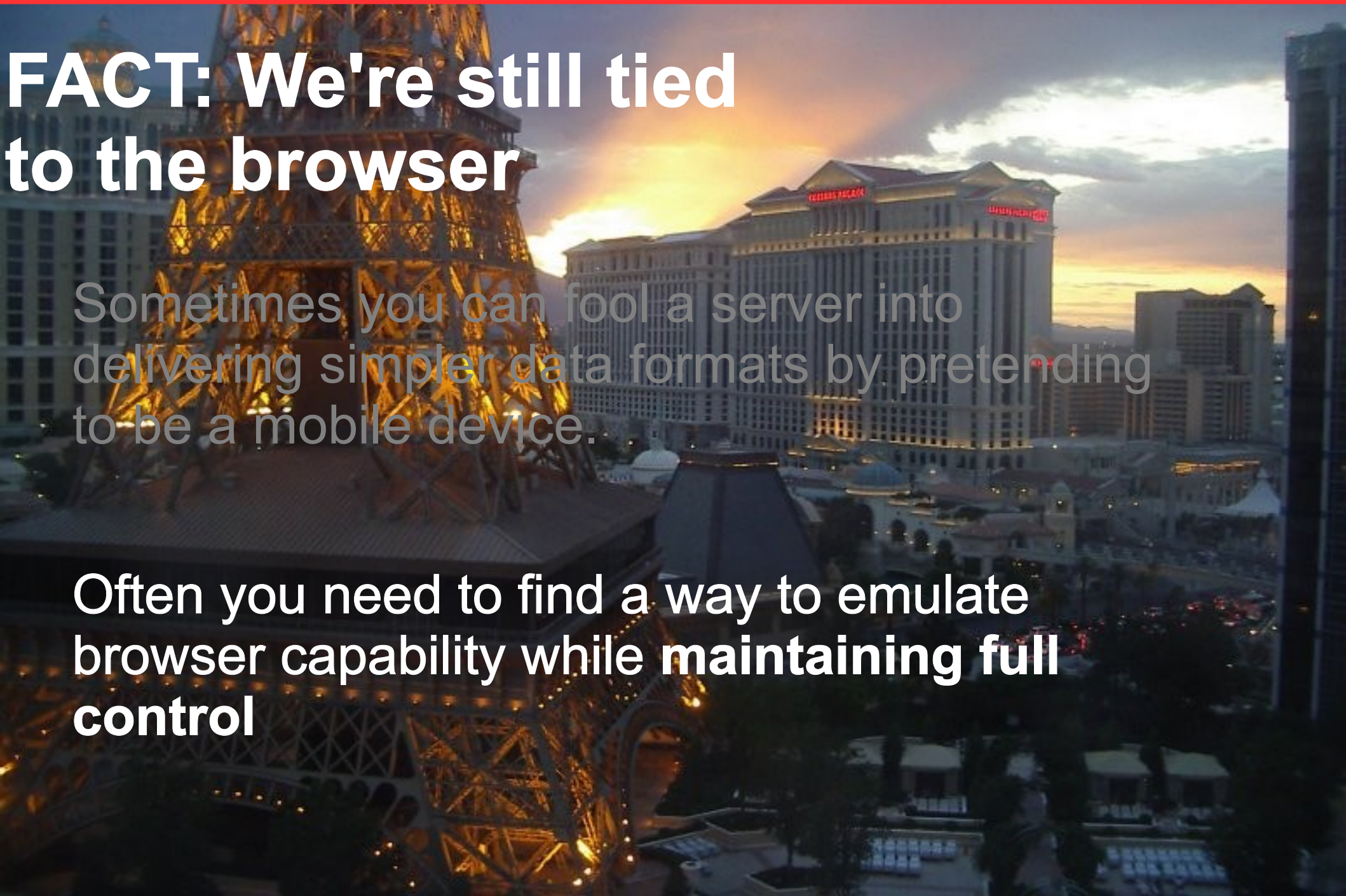

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Browser Macros

- Browser plug-in

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Browser Macros

- Browser plug-in
- Readily available

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Browser Macros

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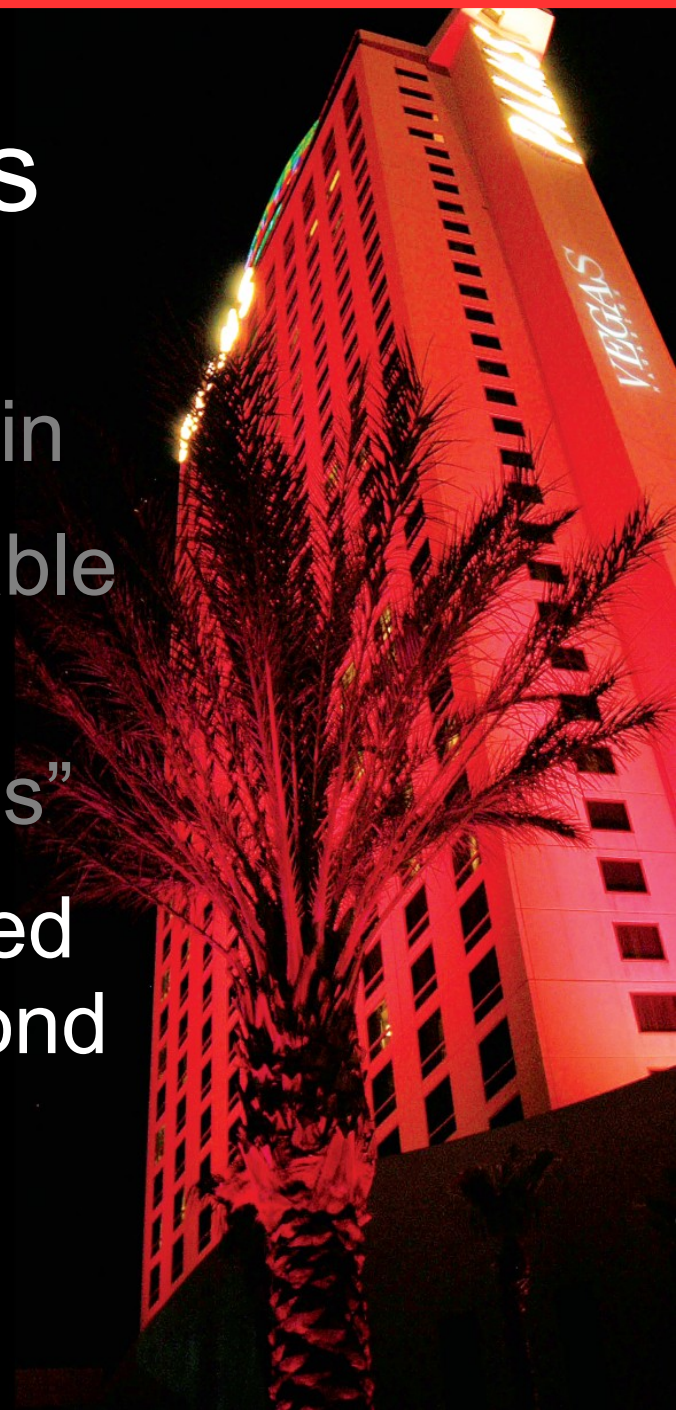
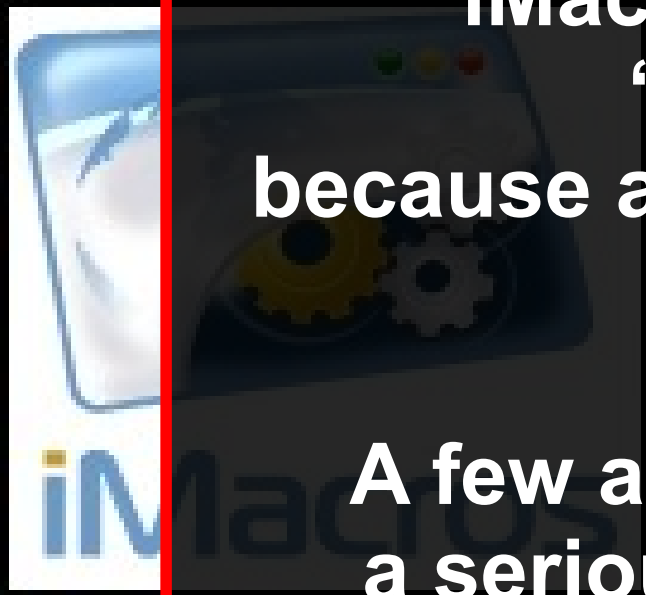
- Solves all the "Difficult Cases"

Browser Macros

- Browser plug-in
- Readily available
- Solves all the "Difficult Cases"
- Easily extended *(hacked)* beyond intended use



Browser Macros



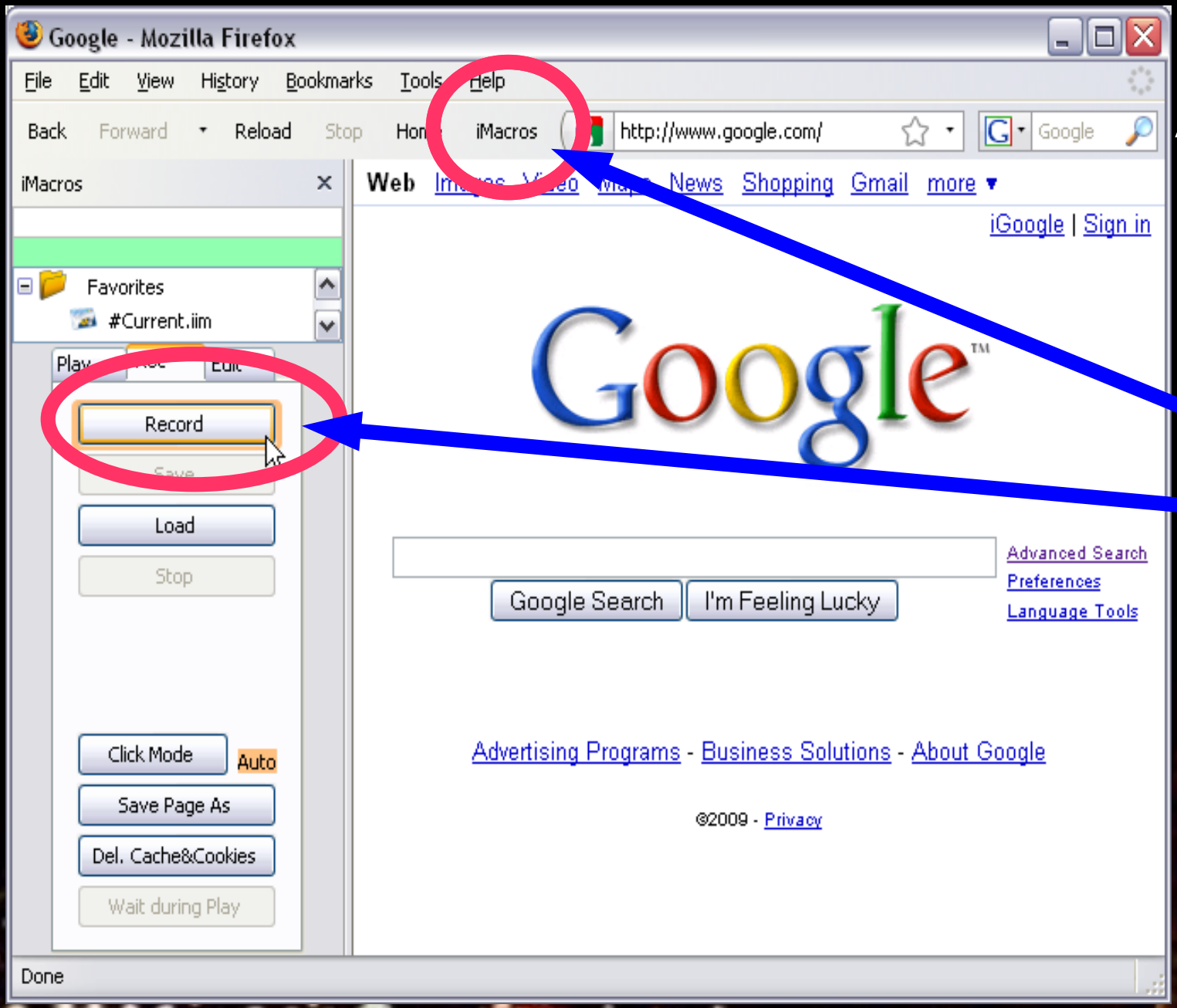
iMacros solves <u>all</u> of the "difficult cases" because an actual browser is used.

A few additional hacks make it a serious screen scraper tool.

INSTALL iMacros

Search for iMacros add-on at addons.mozilla.org

RECORDING A MACRO



Once iMacros is installed

Start the add-on

And press Record

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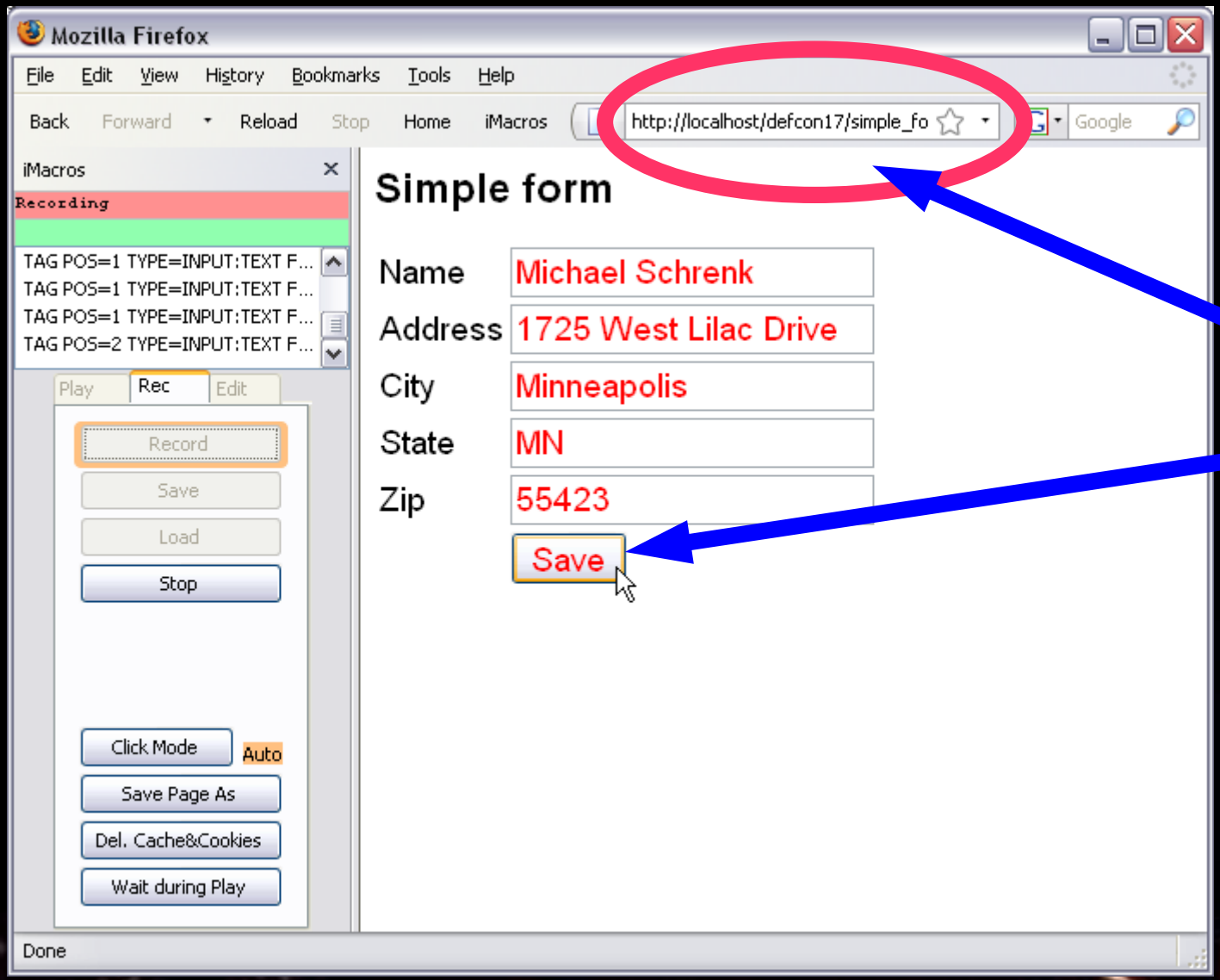
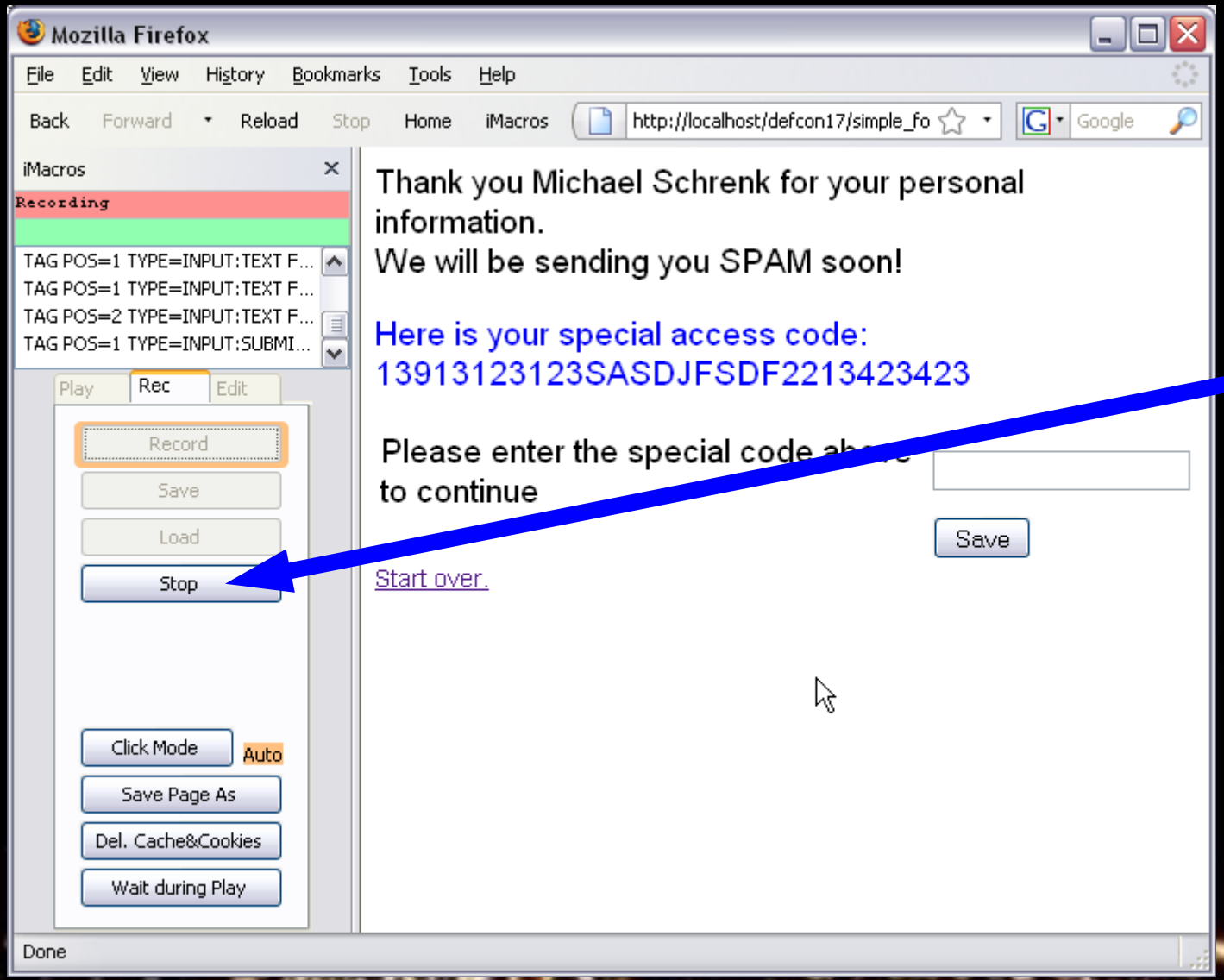
RECORDING A MACRO



Enter URL

Fill form and press Save

RECORDING A MACRO



Press “Stop”

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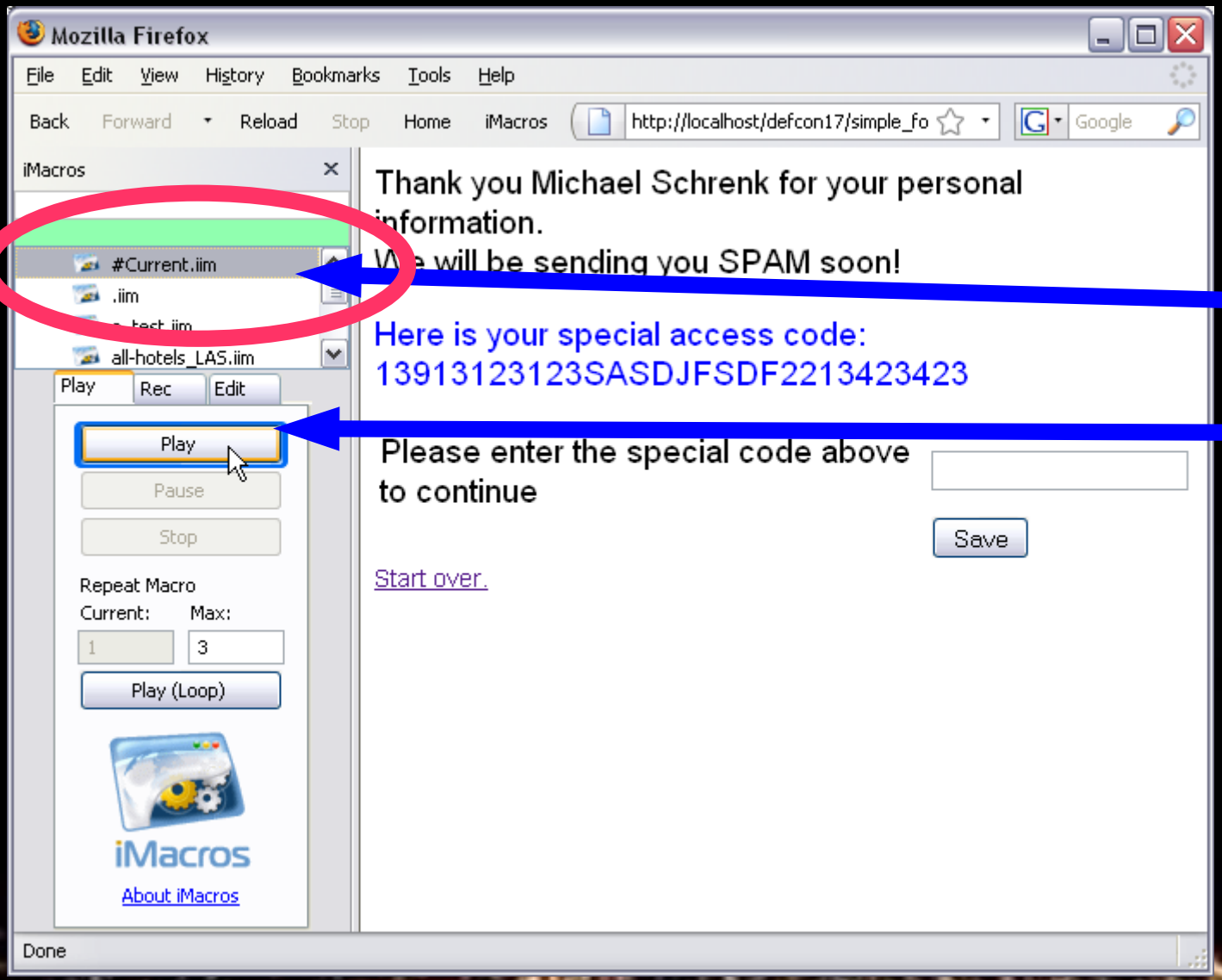
PLAYING A MACRO



Find the #Current.imm macro

And press “Play”

Your macro will replay!

Switch to demo

This is a REALLY SIMPLE demo!

You need to trust me that it will also work in a much more complex environment (i.e. a "difficult case")!

The Macro File (*file_name*.iim)

```
#01    VERSION BUILD=6230608 RECORDER=FX
#02    TAB T=1
#03    URL GOTO=http://www.google.com/
#04    URL GOTO=http://localhost/defcon17/simple_form.php
#05    TAG POS=1 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:name CONTENT=Michael<SP>Schrenk
#06    TAG POS=1 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:address CONTENT=1725<SP>West<SP>Lilac<SP>Drive
#07    TAG POS=1 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:city CONTENT=Minneapolis
#08    TAG POS=1 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:state CONTENT=MN
#09    TAG POS=2 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=ZIP:state CONTENT=55423
#10    TAG POS=1 TYPE=INPUT:SUBMIT FORM=NAME:simple_form
       ATTR=NAME:save&&VALUE:Save
```

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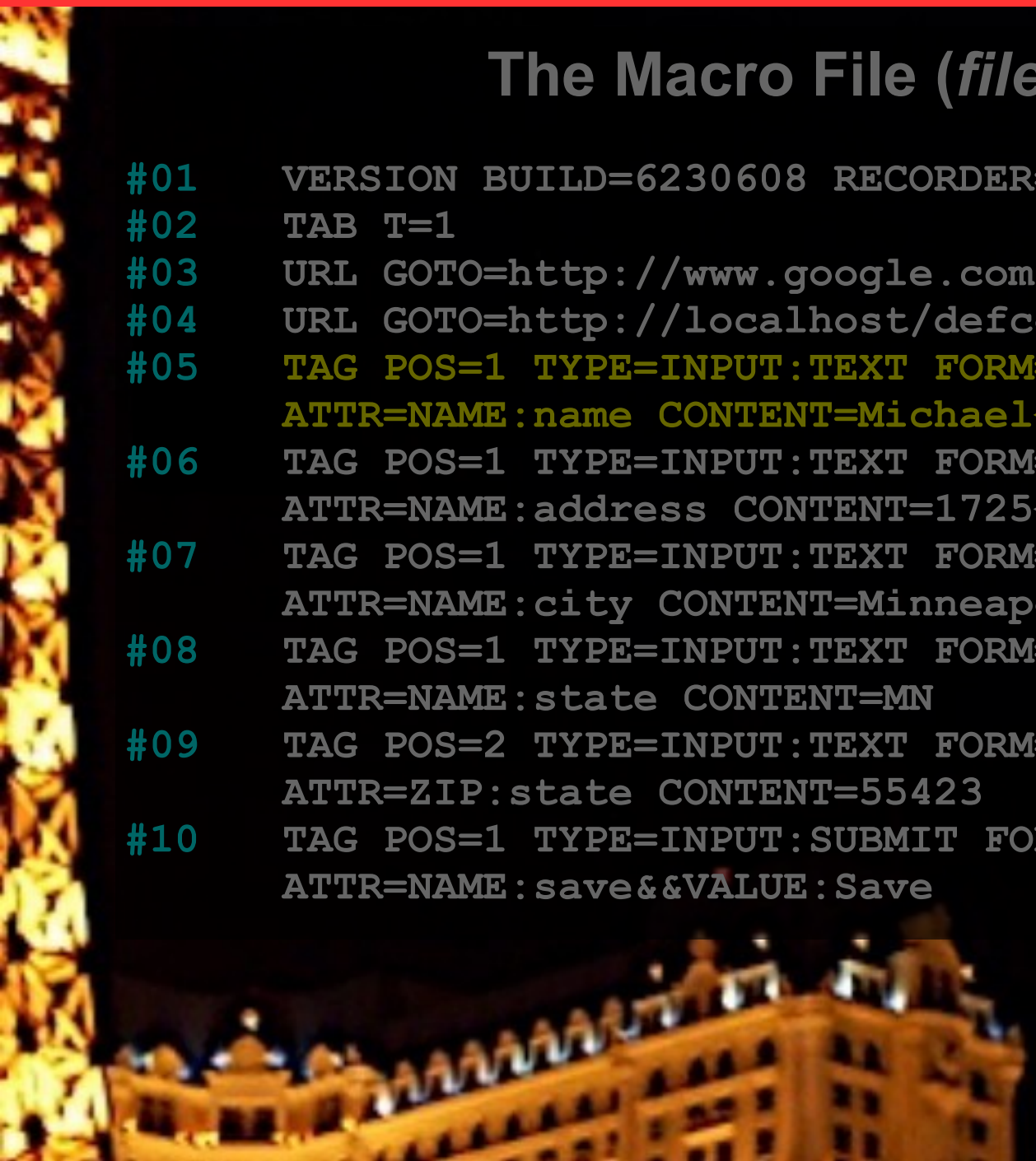
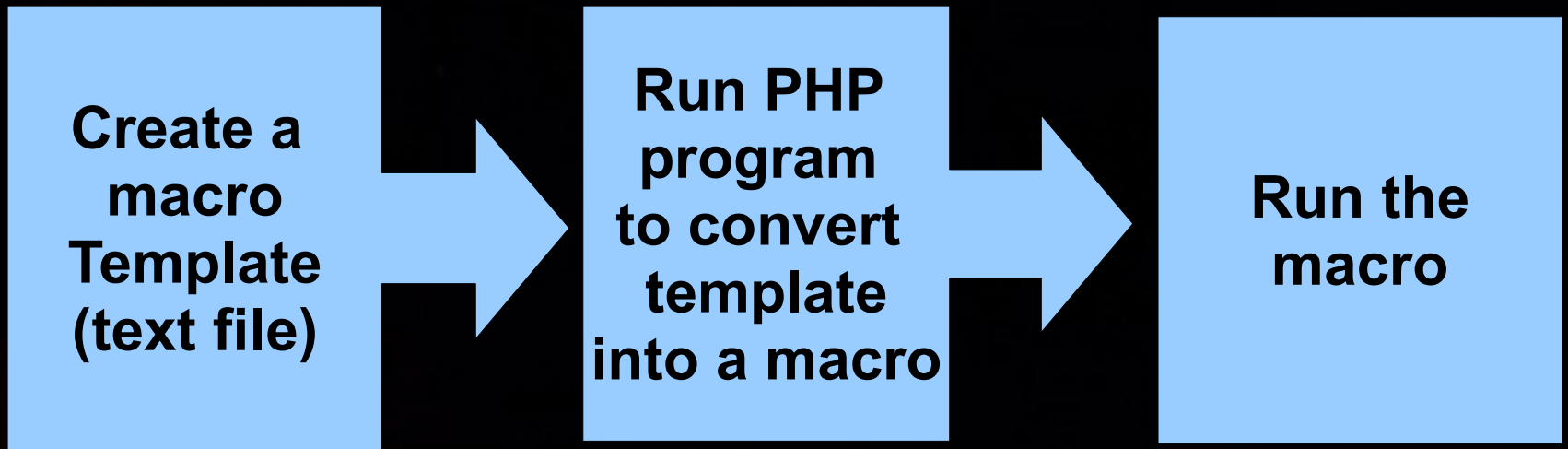


Where Tags can't be identified (FLASH) X/Y coordinates can be used

Dynamic Macro Creation



Creating the Template File

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       ATTR=NAME:address CONTENT=#_ADDRESS_#
#07    TAG POS=1 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:city CONTENT=#_CITY_#
#08    TAG POS=1 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:state CONTENT=#_STATE_#
#09    TAG POS=2 TYPE=INPUT:TEXT FORM=NAME:simple_form
       ATTR=NAME:zip CONTENT=#_ZIP_#
#10    TAG POS=1 TYPE=INPUT:SUBMIT FORM=NAME:simple_form
       ATTR=NAME:save&&VALUE:Save
```

Substituting Variables

```
#01    // Get variables (from somewhere, more on this later)
       $name     = (some data)
       $address  = (some data)
       $city     = (some data)
       $state    = (some data)
       $zip      = (some data)
#02    $macro = file_get_contents("macro.proto");
#03    $macro = str_replace("#_NAME_#", $name, $macro);
#04    $macro = str_replace("#_ADDRESS_#", $address, $macro);
#05    $macro = str_replace("#_CITY_#", $city, $macro);
#06    $macro = str_replace("#_STATE_#", $state, $macro);
#07    $macro = str_replace("#_ZIP_#", $zip, $macro);
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Write the Dynamic Macro file

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#03    $macro = str_replace("#_NAME_#", $name, $macro);
#04    $macro = str_replace("#_ADDRESS_#", $address, $macro);
#05    $macro = str_replace("#_CITY_#", $city, $macro);
#06    $macro = str_replace("#_STATE_#", $state, $macro);
#07    $macro = str_replace("#_ZIP_#", $zip, $macro);
#08    $macro = file_put_contents("macro.imm", $macro);
```

Write the Dynamic Macro file

```
#01    // Get variables (from somewhere, more on this later)
       $name    = (some data)
       $address = (some data)
       $city    = (some data)
       $state   = (some data)
       $zip     = (some data)
#02    $macro = file_get_contents("macro.proto");
#03    $macro = str_replace("# NAME #", $name, $macro);
#04    $macro = str_replace("# ADDRESS #", $address, $macro);
#05    $macro = str_replace("# CITY #", $city, $macro);
#06    $macro = str_replace("# STATE #", $state, $macro);
#07    $macro = str_replace("# ZIP #", $zip, $macro);
#08    $macro = file_put_contents("macro.proto", $macro);
```

Use this substitution technique to dynamically:

1. Program form field values
2. Change the website URL
3. Change delay times
4. Change destination files
5. Change status message values
6. Etc., etc., etc.

Write the Dynamic Macro file

```
#01    // Get variables (from somewhere, more on this later)
       $name     = (some data)
       $address  = (some data)
       $city     = (some data)
       $state    = (some data)
       $zip      = (some data)
#02    $macro = file_get_contents("macro.proto");
#03    $macro = str_replace("#_NAME_#", $name, $macro);
#04    $macro = str_replace("#_ADDRESS_#", $address, $macro);
#05    $macro = str_replace("#_CITY_#", $city, $macro);
#06    $macro = str_replace("#_STATE_#", $state, $macro);
#07    $macro = str_replace("#_ZIP_#", $zip, $macro);
#08    $macro = file_put_contents("macro.proto", $macro);
```

Use the programmability to:

1. Create loops
2. Change data sources
3. Send status messages to central server
4. Etc., etc., etc.

Launching iMacros (macro) from PHP

```
#01 <?php
#02 if($os=="linux")
#03    {
#04    system("firefox http://www.google.com" );
#05    sleep(5);
#06    system("firefox http://run.imacros.net/?
       m=macro_name.iim");
#07    }
#08 else
#09    {
#10    system("start /B firefox http://run.imacros.net/?
       m=macro_name.iim");
#11    }
#12 ?>
```

Launching iMacros (macro) in a cron

I've had better luck launching iMacros (as a scheduled task) as a batch file (Windows) or a BASH file (Linux)

If scheduled on a Linux system, remember to specify a video output.

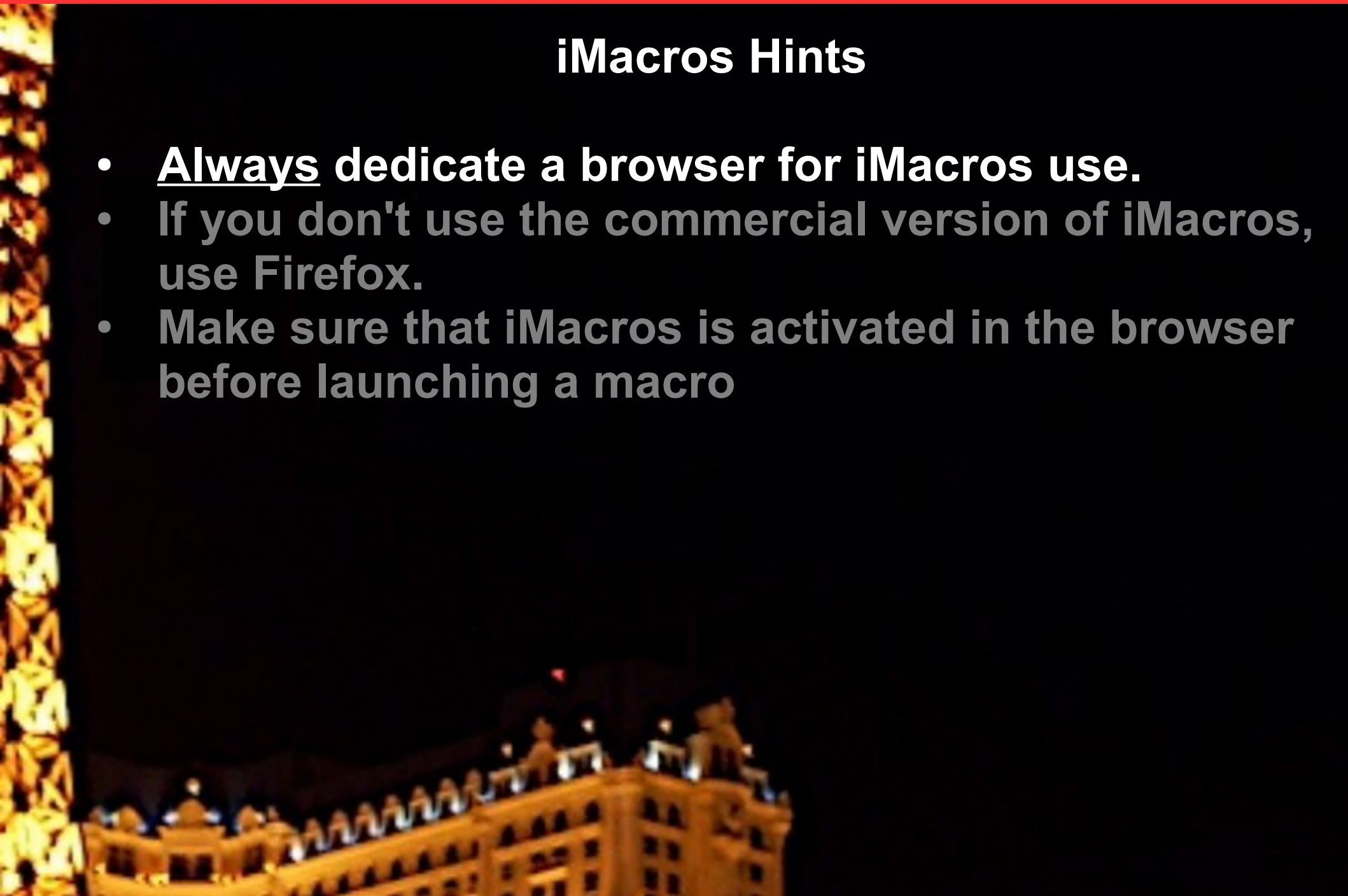
```
Display =:0 php /pathname/php_program.php
```

Launching iMacros (macro) in a cron

I've had better luck launching iMacros (as a scheduled task) as a batch file (Windows) or a BASH file (Linux)

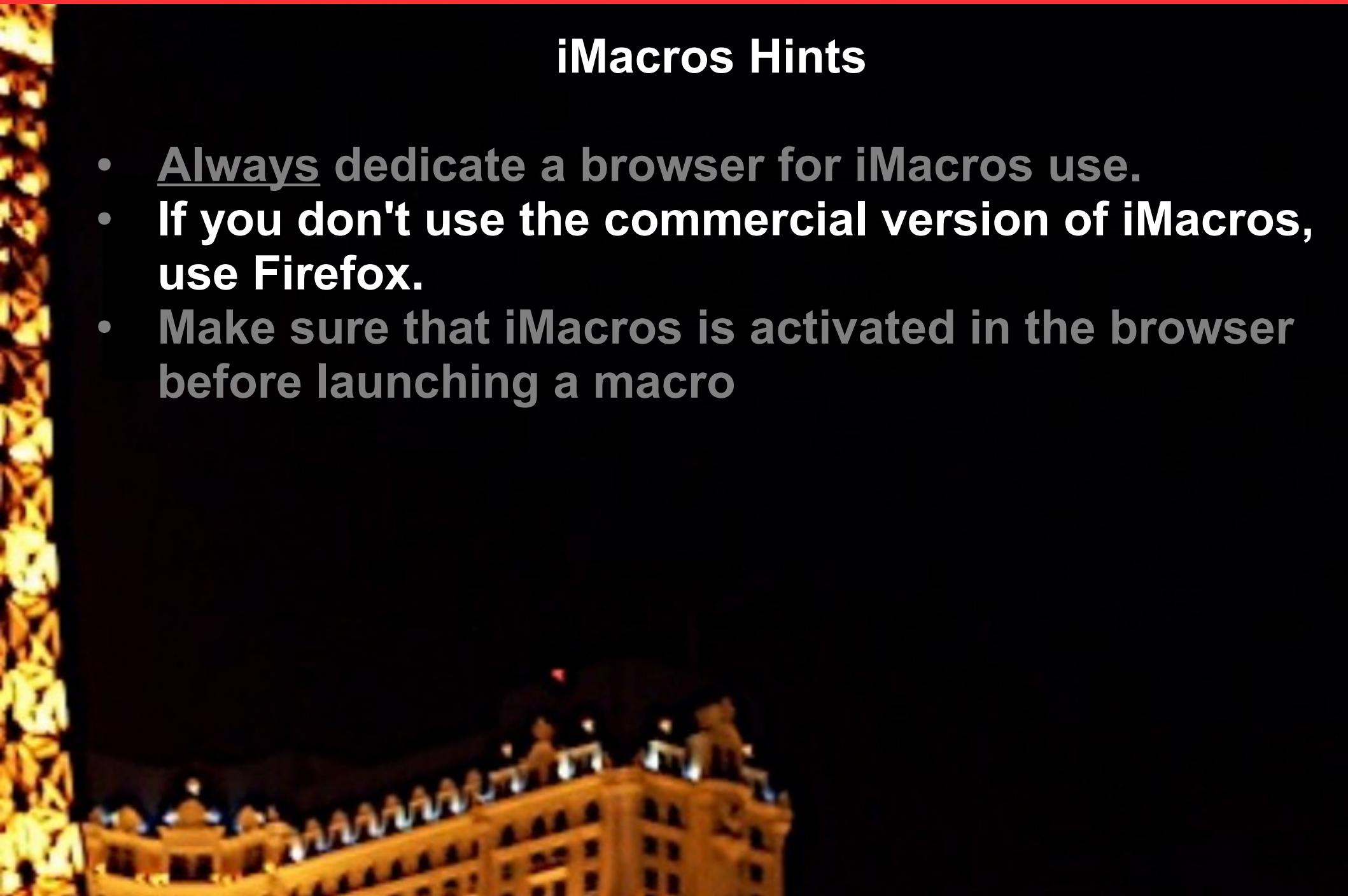
If scheduled on a Linux system, remember to specify a video output.

```
Display =:0 php /pathname/php_program.php
```



iMacros Hints

- Always dedicate a browser for iMacros use.
- If you don't use the commercial version of iMacros, use Firefox.
- Make sure that iMacros is activated in the browser before launching a macro



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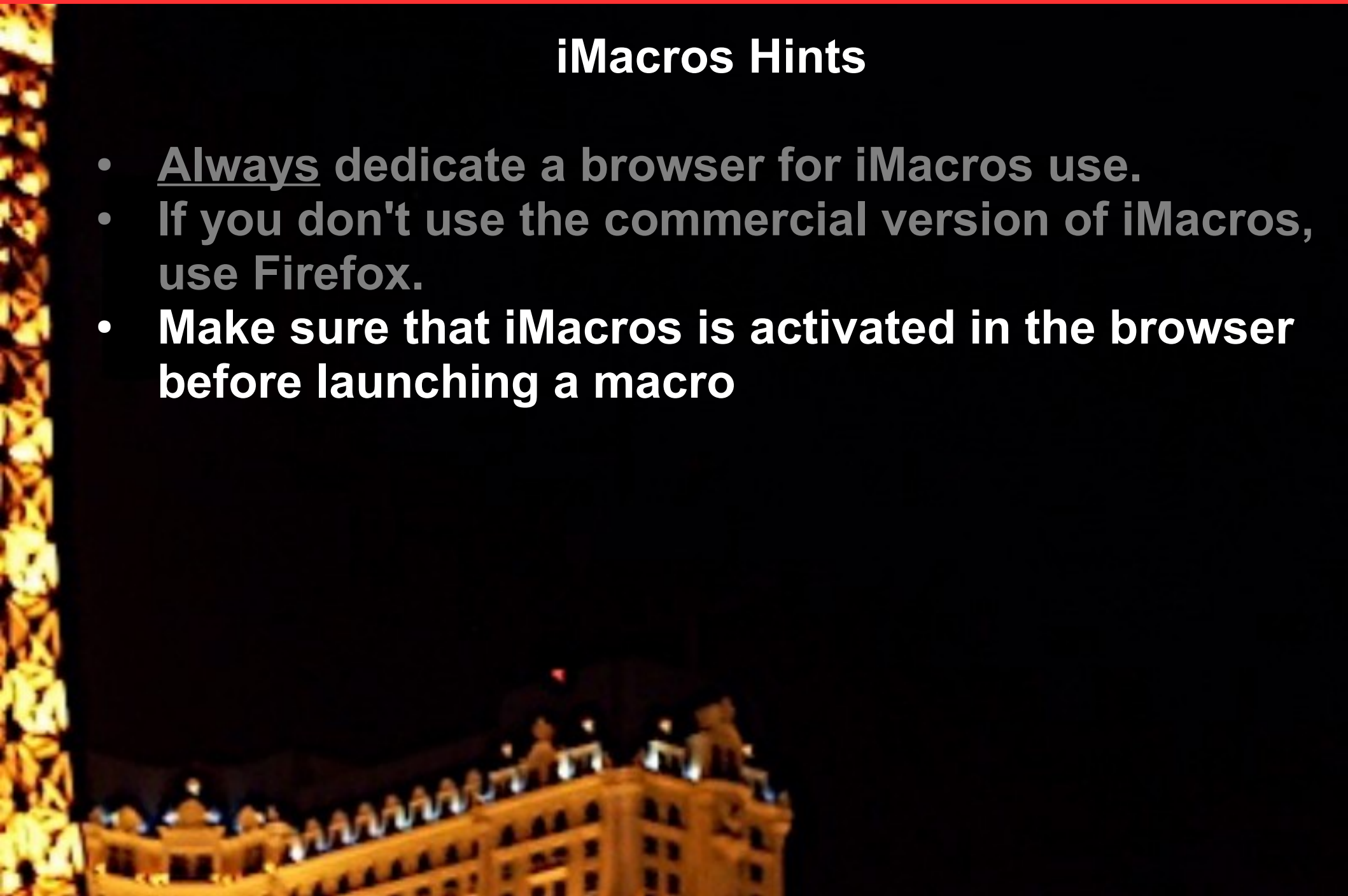

iMacros Hints

- Always dedicate a browser for iMacros use.
- If you don't use the commercial version of iMacros, use Firefox.
- **Make sure that iMacros is activated in the browser before launching a macro**

Preferred iMaco Header commands

```
#01    '#############################################################
#02    ' Set maximum web page time out
#03    SET !TIMEOUT 240
#04    ' Tell iMacros to ignore error messages
#05    SET !ERRORIGNORE YES
#06    ' Clear ALL cookies
#07    CLEAR
#08    ' Initialize Browser tab 1, close all other tabs
#09    TAB T=1
#10    TAB CLOSEALLOTHERS
#11    ' Tell iMacros to ignore images (nice if using Tor)
#12    FILTER TYPE=IMAGES STATUS=ON
#13    ' Tell iMacros to ignore extract messages
#14    SET !EXTRACT_TEST_POPUP NO
#15    '#############################################################
```

Preferred iMaco Header commands

```
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#02    ' Set maximum web page time out
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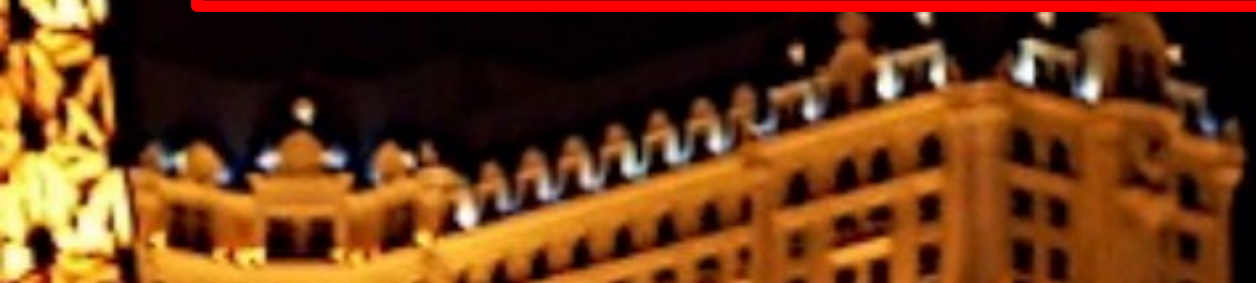
#06  ' Clear ALL cookies
#07  CLEAR
#08  ' Initialize Browser, close all other tabs
#09  TAB T=1
#10  TAB CLOSEALLOTHERS
#11  ' Make sure images are enabled (Default)
#12  FILTER TYPE=IMAGES STATUS=ON
#13  ' Tell iMacros to ignore extract messages
#14  SET !EXTRACT_TEST_POPUP NO
#15  '#############################################################
```

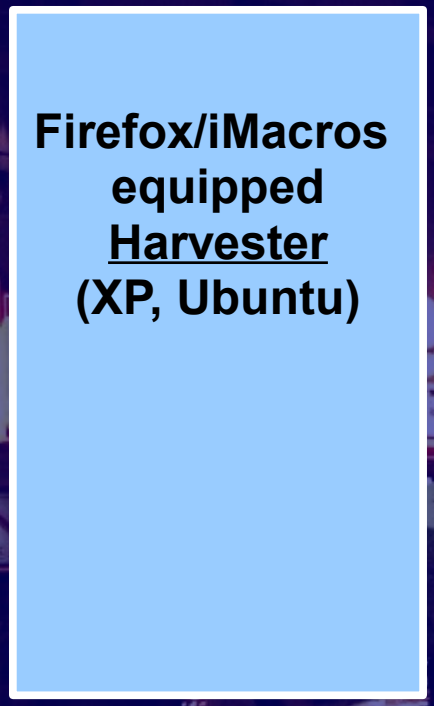
A complete iMacros command reference Is available at:

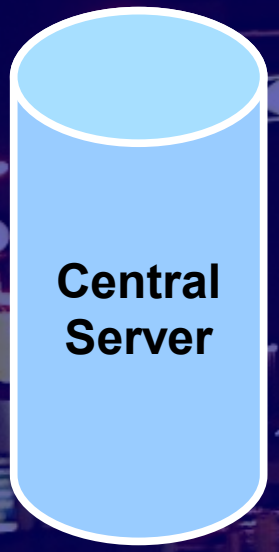
wiki.imacros.net/Command_Reference



Las Vegas, Nevada
mike@schrenk.com

Let's look at where the data can come from





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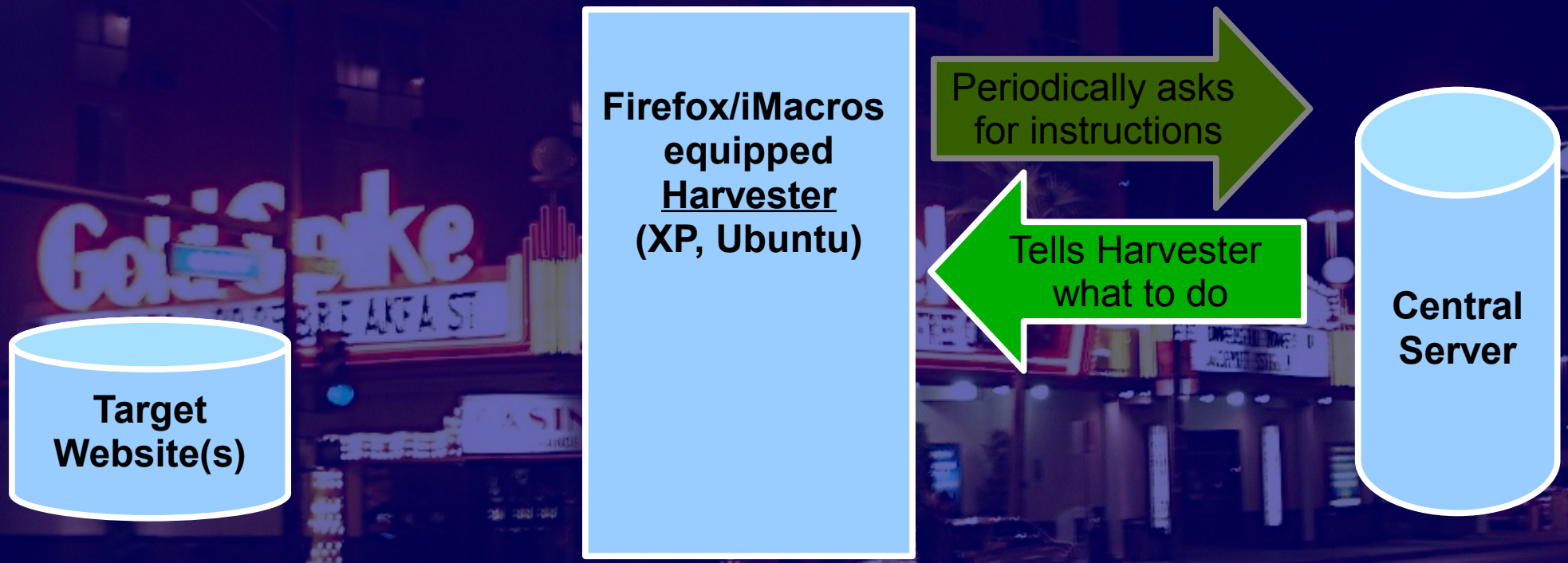

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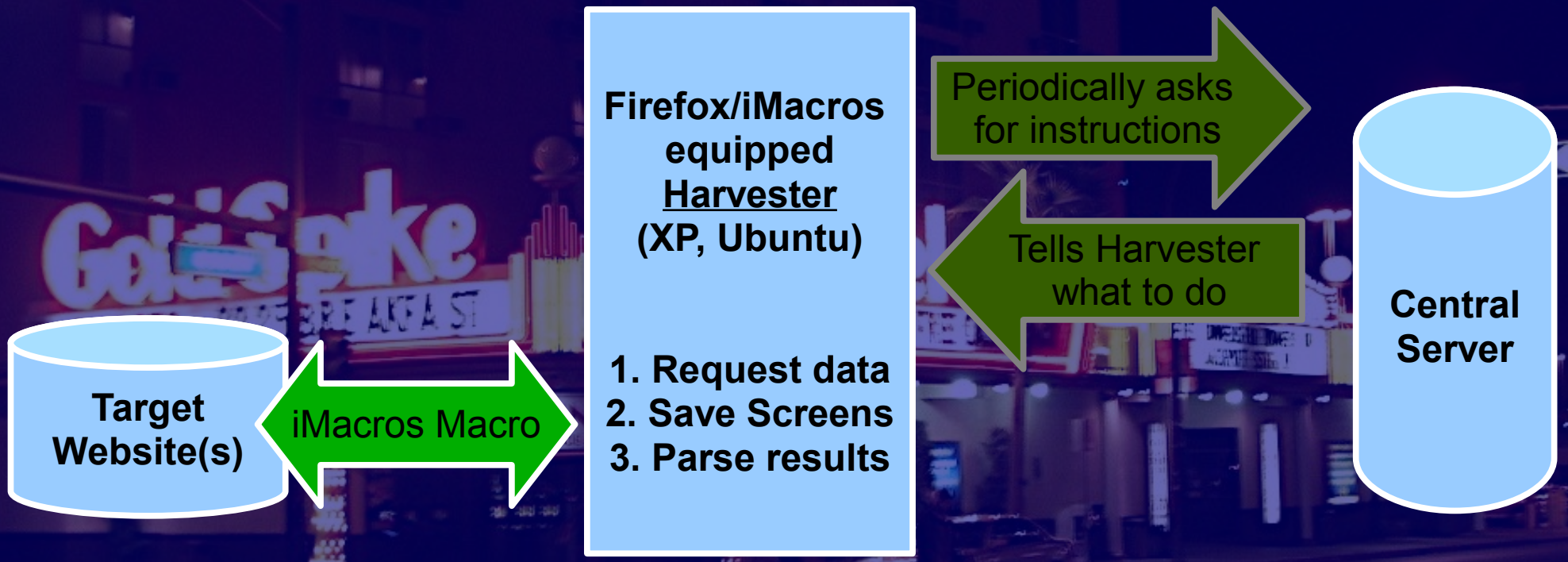

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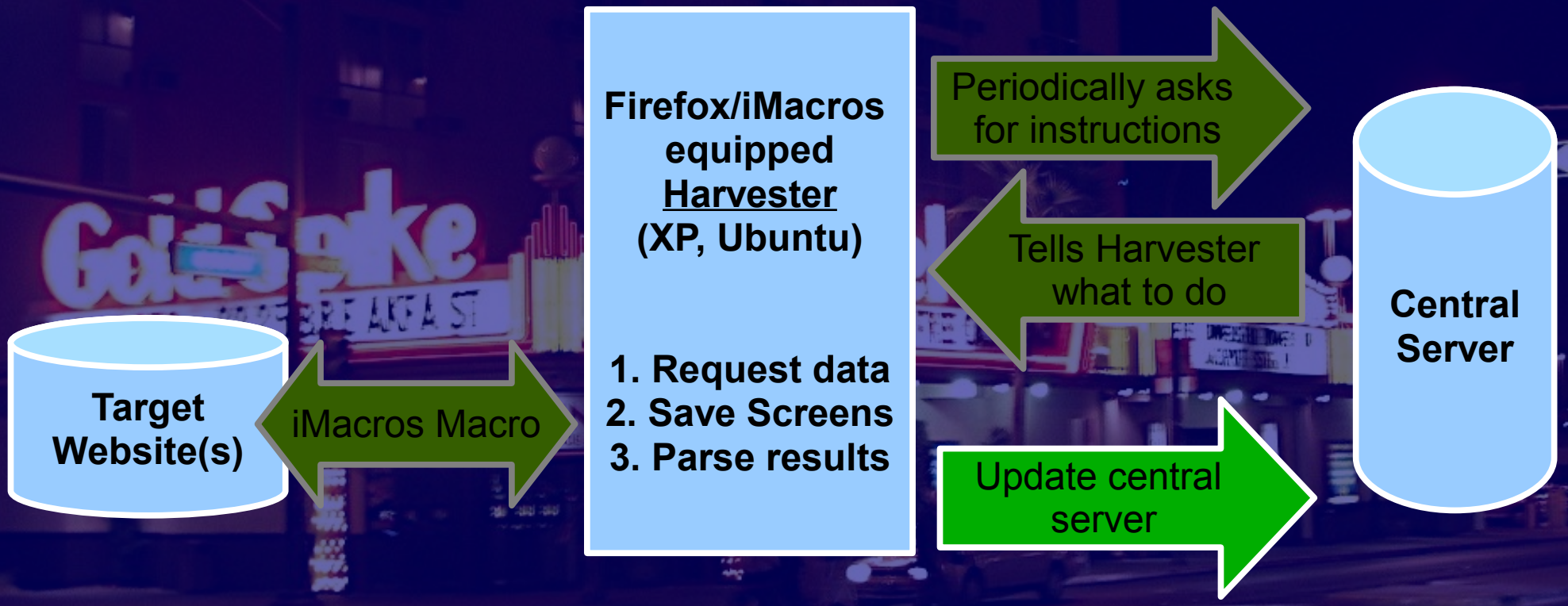

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Large scale deployment

(challenges traditional thoughts regarding hosting)

Advanced iMacros Hacks

First example was a very straight forward iMacros example

iMacros also some JavaScript-like scripting compatibility (in the paid version)

iMacros has limited parsing and data extraction capability

While solving many problems--without further hacking, iMacros leaves you with many (or most) browser limitations.

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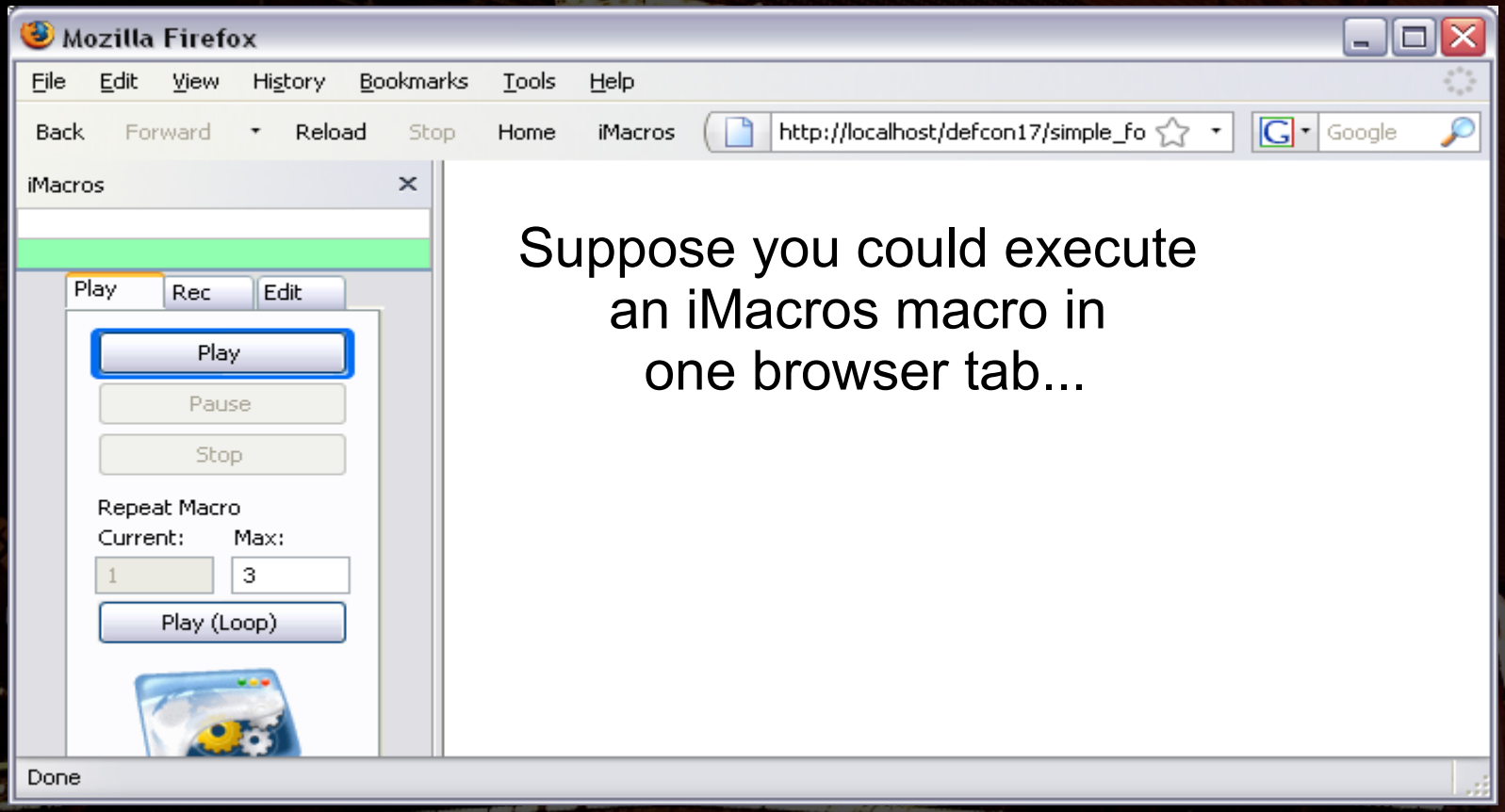

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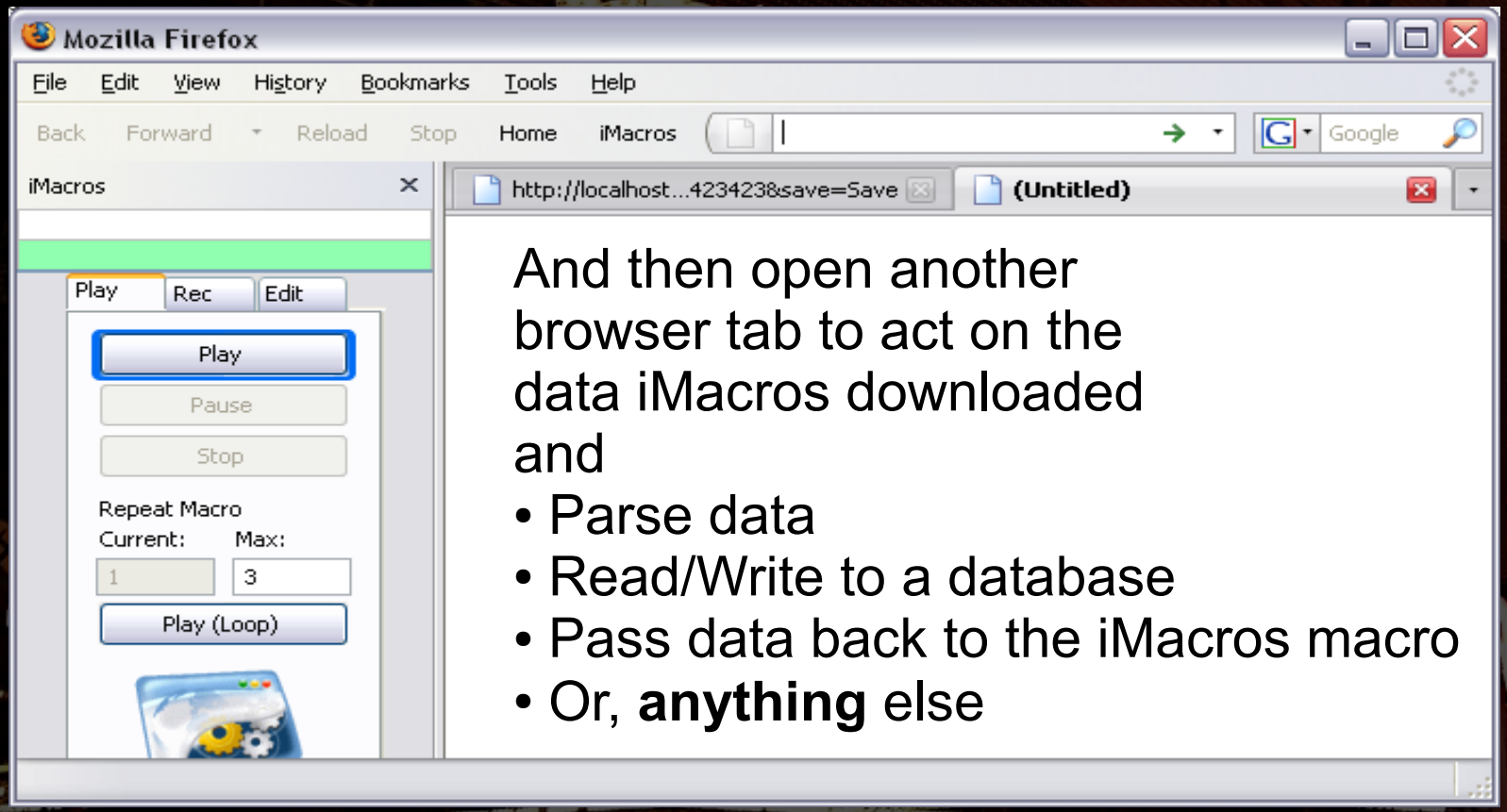

And then open another browser tab to act on the data iMacros downloaded and

- Parse data
- Read/Write to a database
- Pass data back to the iMacros macro
- Or, **anything** else

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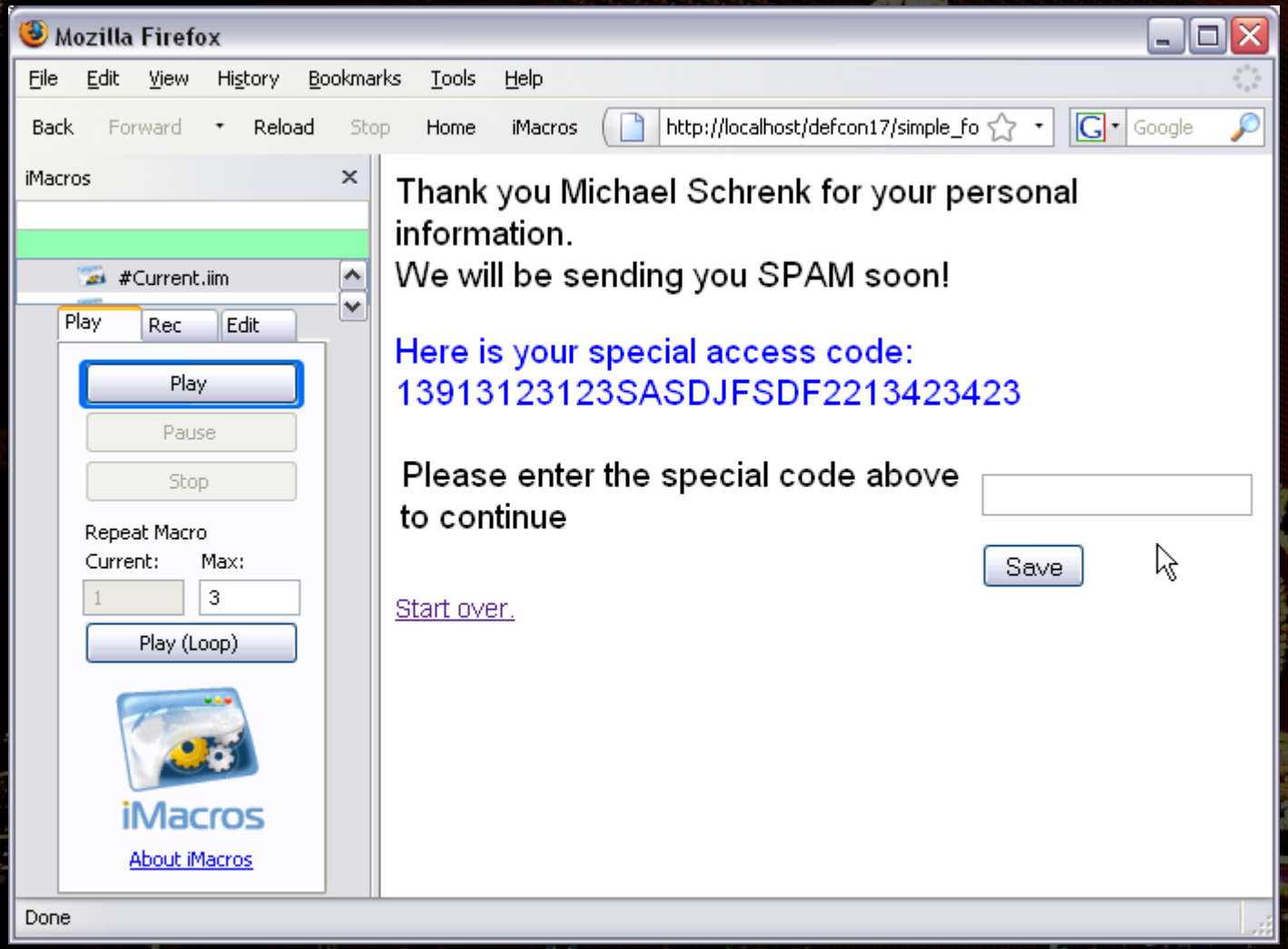
Advanced iMacros Hacks



Let's finish our first example!

When we get to this point:

- Create a 2nd tab
- Launch a local php program in Apache
- Parse the web page
- Return the access code
- Complete the form submission in the original tab

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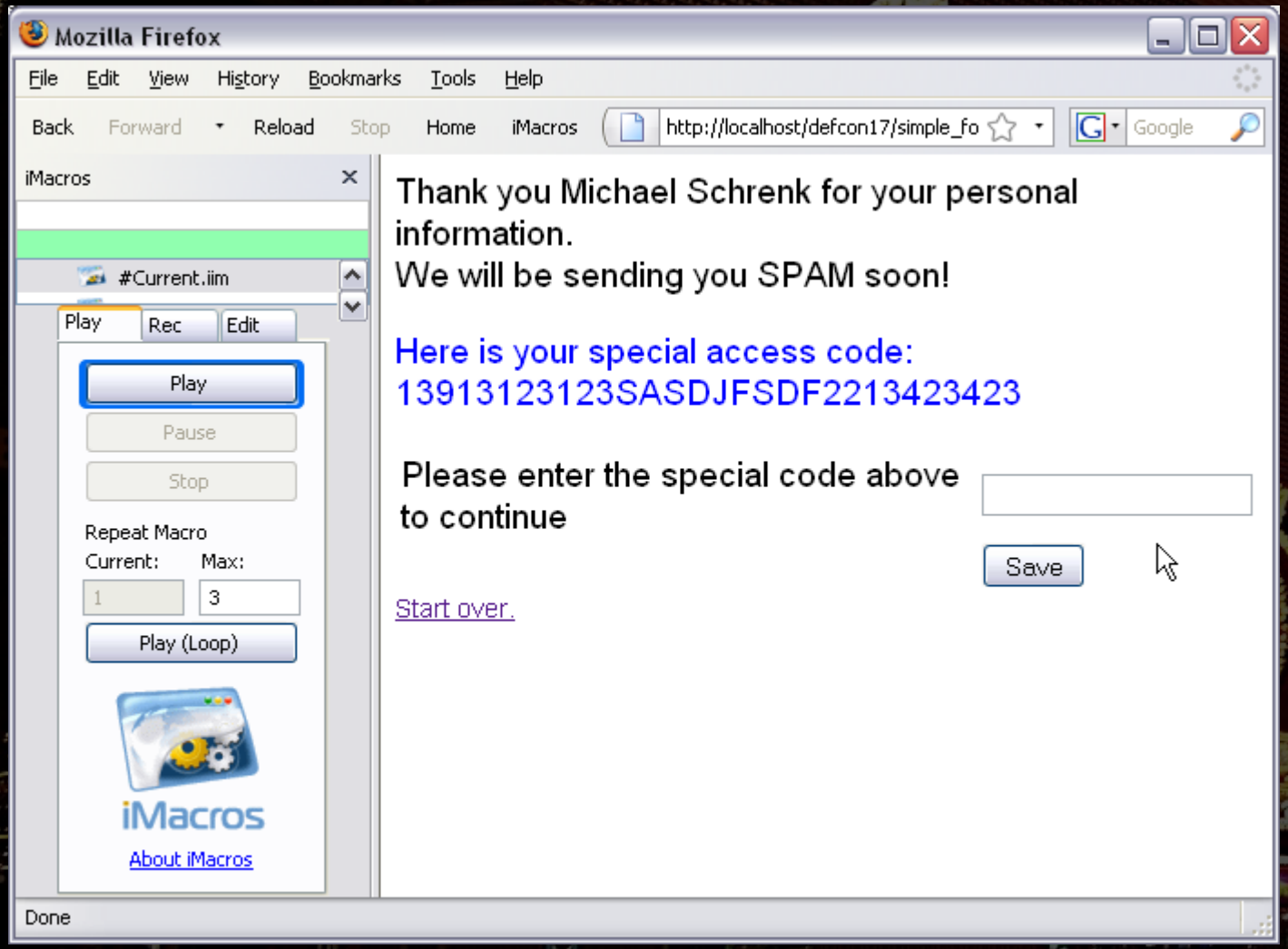
Advanced iMacros Hacks



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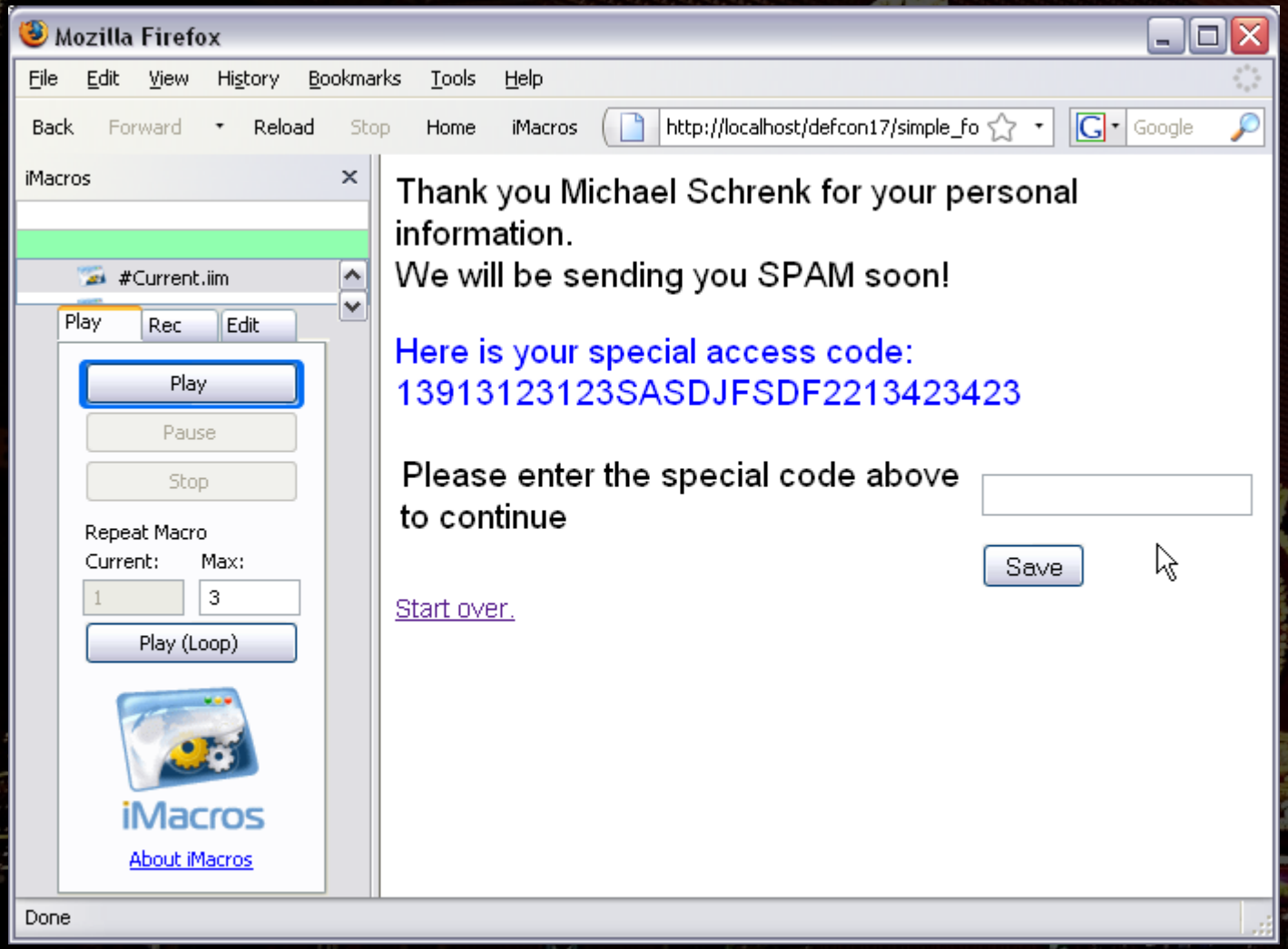
Advanced iMacros Hacks



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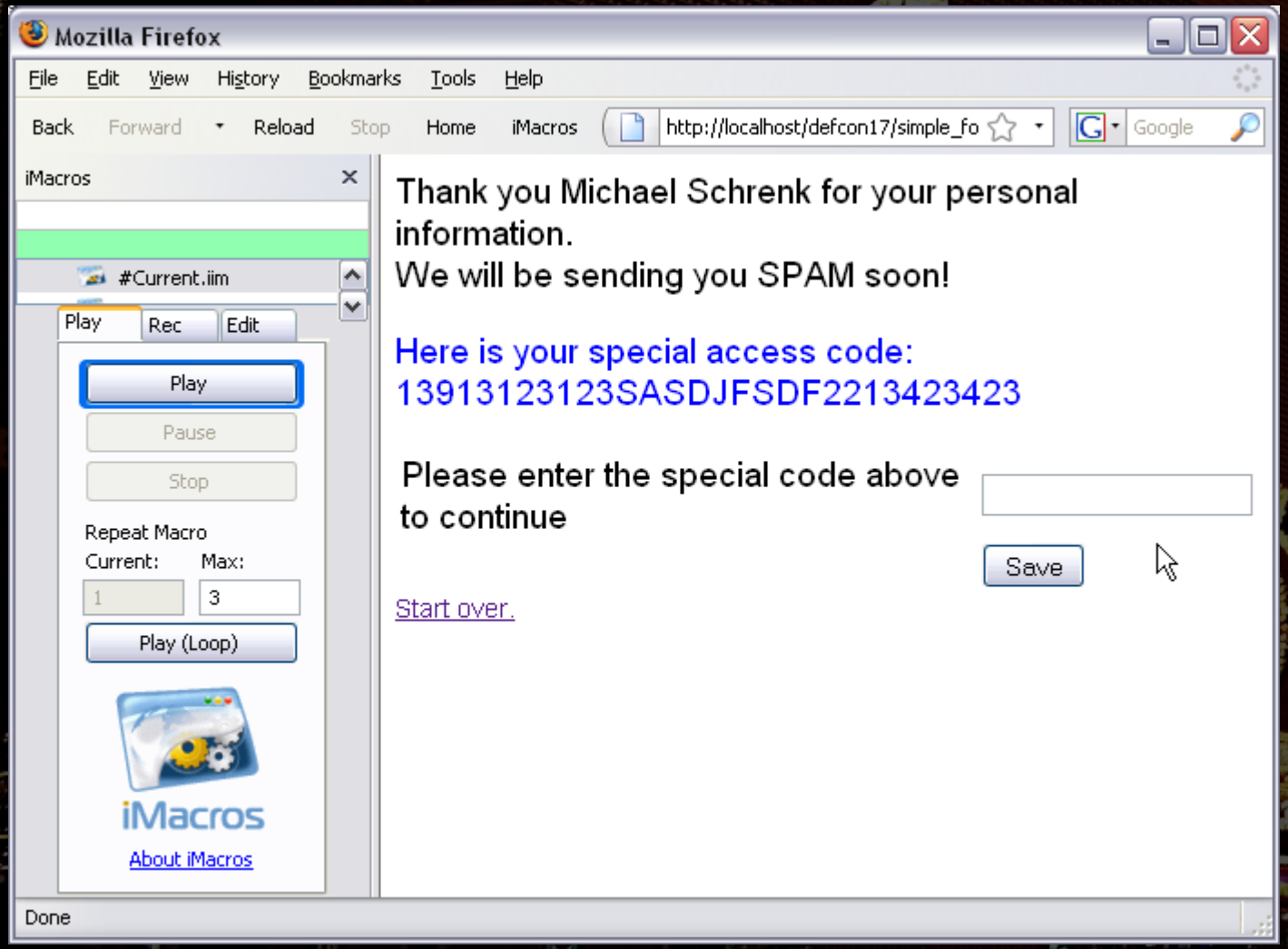

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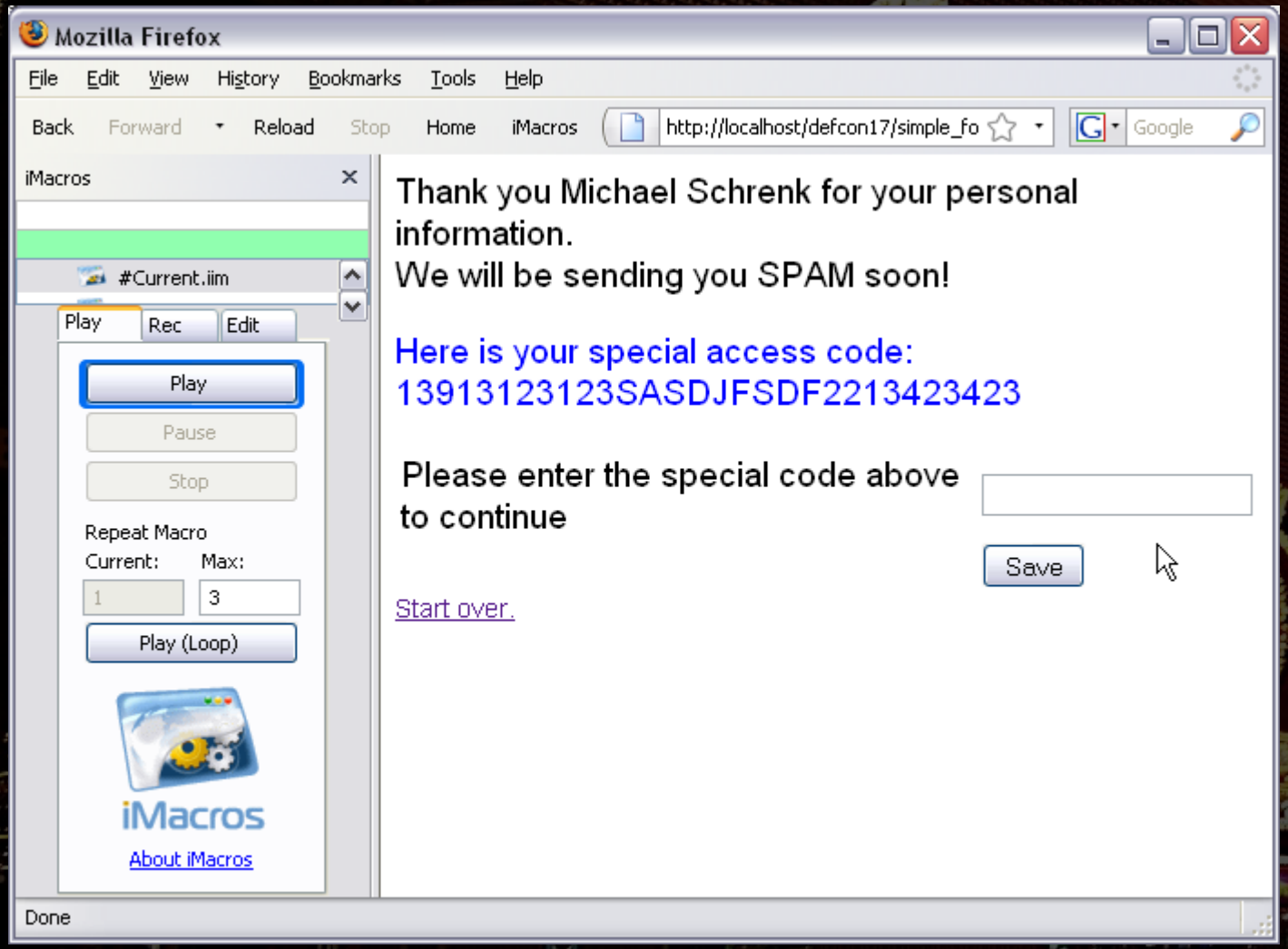
Advanced iMacros Hacks



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When we get to this point:

- Create a 2nd tab
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Switch to demo #2

You need to trust me that it will also work in a more complex environment (i.e. a "difficult case")!

This code was added to the original iMacros macro

```
#01    '# SAVE A COPY OF THE WEBPAGE TO FILE SYSTEM
#02    SAVEAS TYPE=HTM FOLDER=* FILE=PARSE_FILE.html
#03    '# OPEN A NEW TAB FOR THE PARSING SOFTWARE
#04    TAB OPEN
#05    TAB T=2
#06    URL GOTO=http://localhost/defcon17/simple_parse.php
#07    '
#08    '# READ THE PARSED RESULTS
#09    TAB T=1
#10    CMDLINE !DATASOURCE data.csv
#11    SET !DATASOURCE_COLUMNS 1
#12    SET !DATASOURCE_LINE {{!LOOP}}
#13    TAG POS=1 TYPE=INPUT:TEXT
          FORM=NAME:simple_form
          ATTR=NAME:access_code CONTENT={{!COL1}}
#14    WAIT SECONDS=5
#15    TAG POS=1 TYPE=INPUT:SUBMIT FORM=NAME:simple_form
          ATTR=NAME:save&&VALUE:Save
```

Saves a copy of the screen data to a file in the /iMacros/Downloads directory.

This code was added to the original iMacros macro

```
#01    '# SAVE A COPY OF THE WEBPAGE TO FILE SYSTEM
#02    SAVEAS TYPE=HTM FOLDER=* FILE=PARSE_FILE.html
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#04    TAB OPEN
#05    TAB T=2
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#07    '
#08    '# READ THE PARSED RESULTS
#09    TAB T=1
#10    CMDLINE !DATASOURCE data.csv
#11    SET !DATASOURCE_LINE {{!COL1}}
#12    SET !DATASOURCE_LINE {{!COL2}}
#13    TAG POS=1 TYPE=INPUT:TEXT
          FORM=NAME:simple_form
          ATTR=NAME:access_code CONTENT={{!COL1}}
#14    WAIT SECONDS=1
#15    TAG POS=1 TYPE=INPUT:SUBMIT FORM=NAME:simple_form
          ATTR=NAME:save&&VALUE:Save
```

- Opens the second tab
- Loads and runs the file “simple_parse.php” on a local installation of Apache

This program

- Reads the previously stored file
- Parses the access code
- Stores it in a iMacros (CSV) data file

This code was added to the original iMacros macro

```
#01    '# SAVE A COPY OF THE WEB PAGE TO FILE SYSTEM
#02    SAVEAS TYPE=HTM FOLDER=* FILE=PARSE_FILE.html
#03    '# OPEN A NEW TAB FOR THE PARSED RESULTS
#04    TAB OPEN
#05    TAB T=2
#06    URL GOTO=http://localhost/demo17/original_page.php
#07    '
#08    '# READ THE PARSED RESULTS
#09    TAB T=1
#10    CMDLINE !DATASOURCE data.csv
#11    SET !DATASOURCE_COLUMNS 1
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#14    WAIT SECONDS=5
#15    TAG POS=1 TYPE=INPUT:SUBMIT FORM=NAME:simple_form
          ATTR=NAME:save&&VALUE:Save
```

- **Return to first tab**
- **Read (CSV) data file**
- **Insert data into form**

This is a simplified example, can also employ loops (CSV rows) and many more data fields (CSV columns)

This code was added to the original iMacros macro

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```
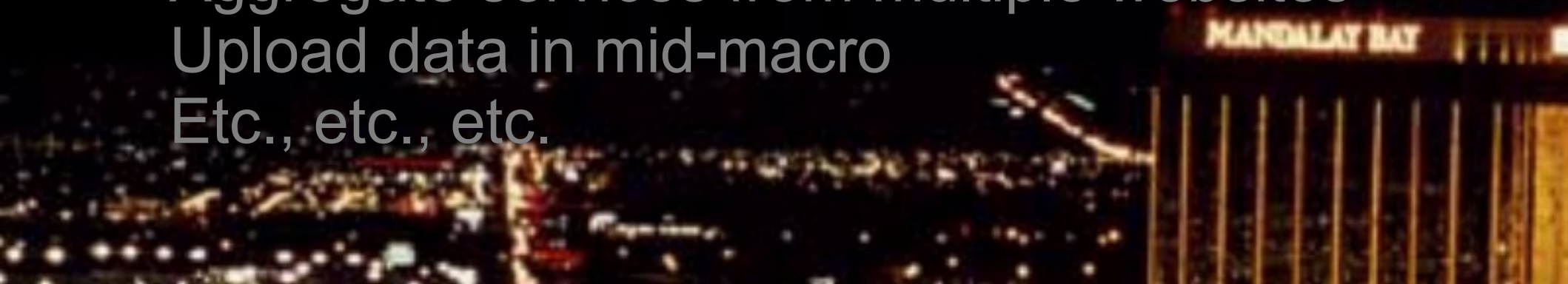

Submit form

Using **additional tabs** to run **local programs** facilitates advanced features not possible in traditional iMacros configurations

Interrupted macros
- Parse data from pages and act on results
- Interface with local peripherals
- Change proxy settings
- Aggregate data from multiple websites
- Aggregate services from multiple websites
- Upload data in mid-macro
- Etc., etc., etc.



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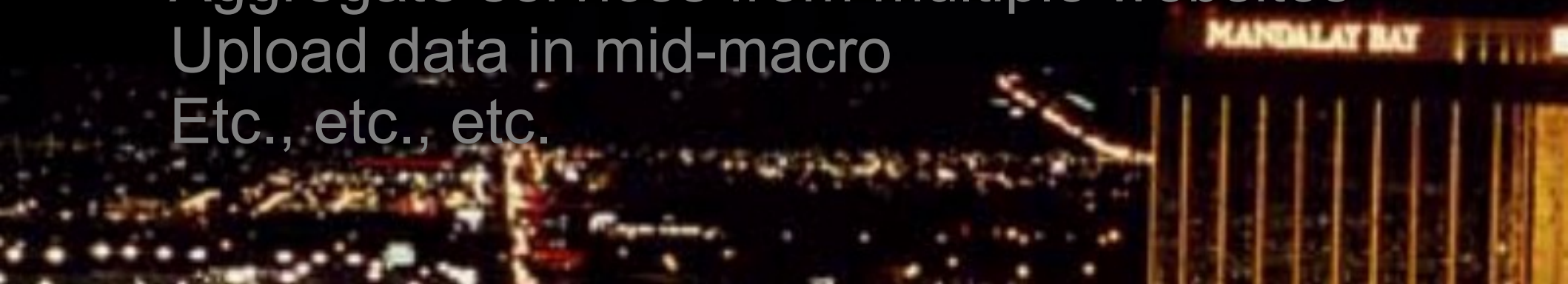

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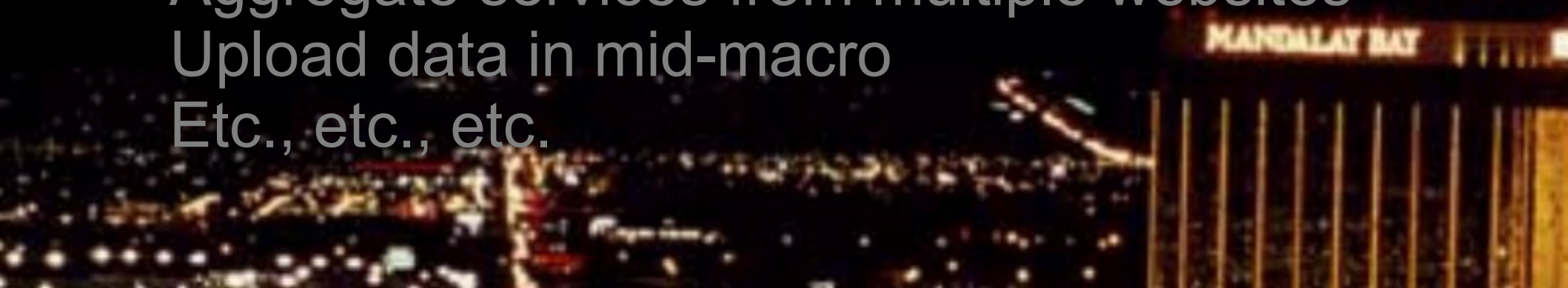

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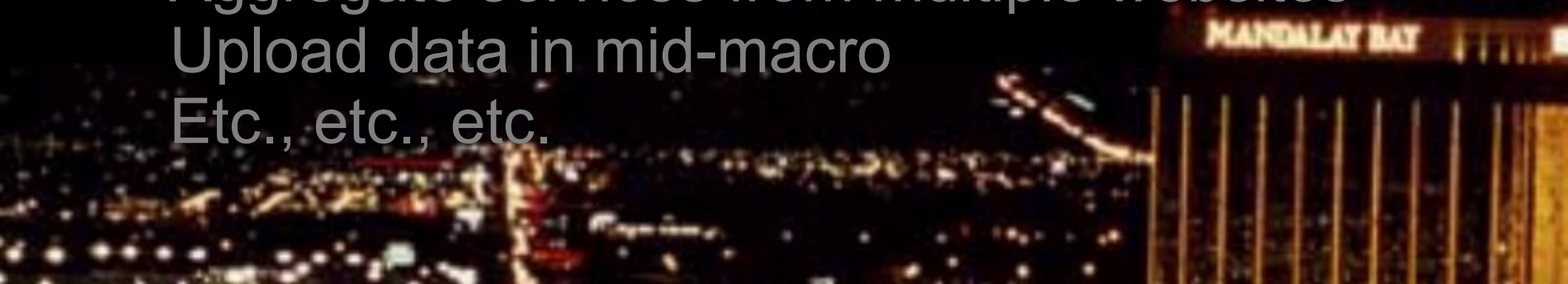

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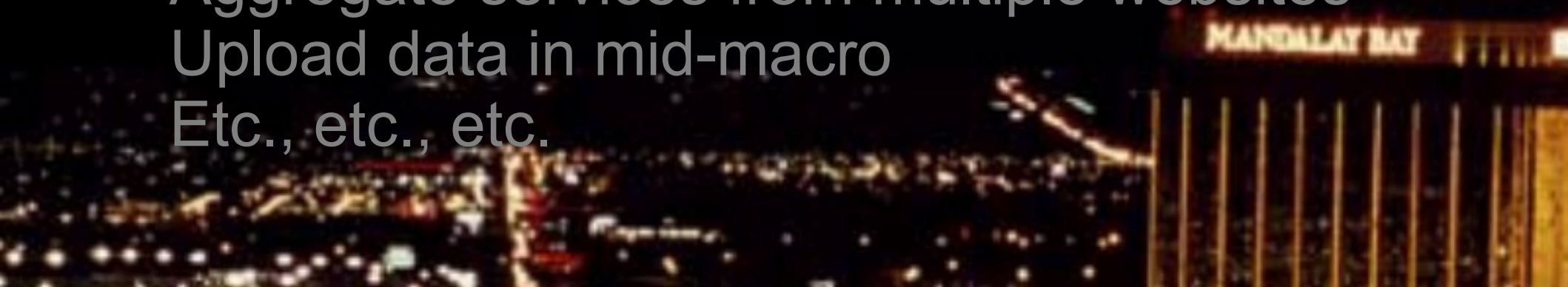

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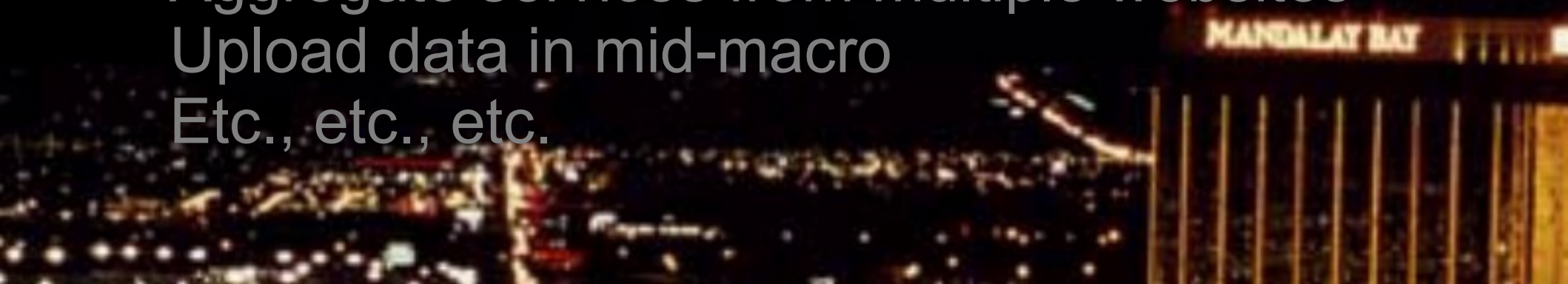
Interrupted macros

- Parse data from pages and act on results
- Interface with local peripherals
- Change proxy settings
- Aggregate data from multiple websites
- Aggregate services from multiple websites
- Upload data in mid-macro
- Etc., etc., etc.



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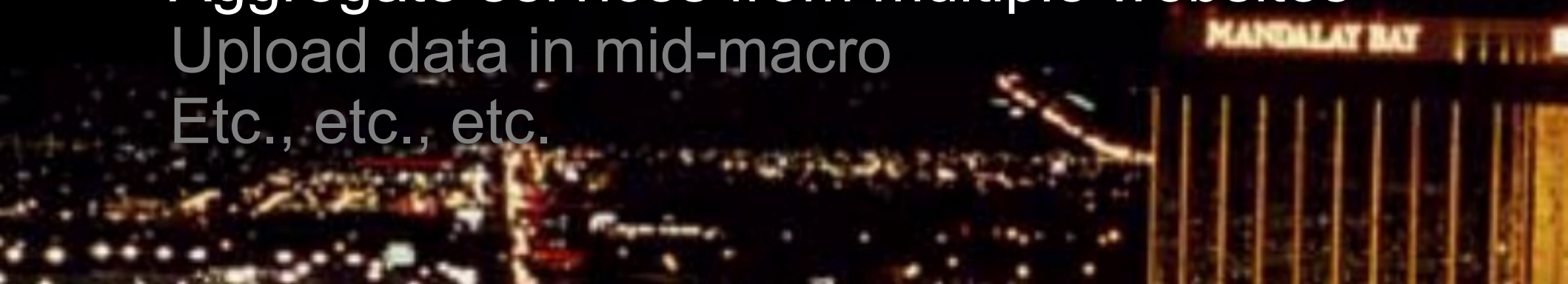

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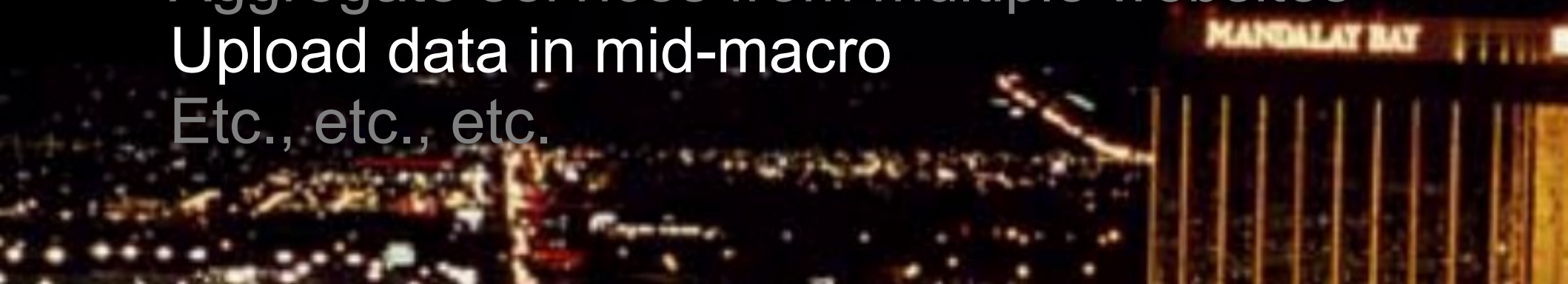

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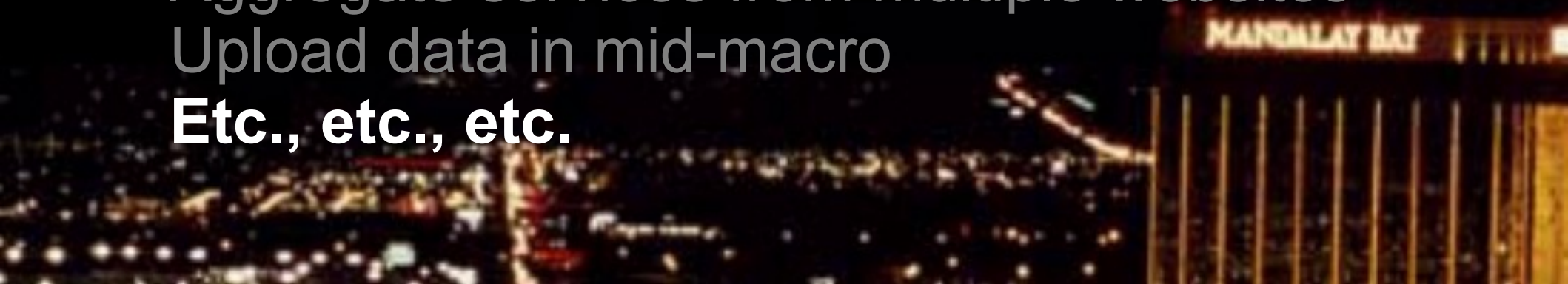

Las Vegas, Nevada
mike@schrenk.com

Heartwarming moment

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mike@schrenk.com

ReCAPTCHA

250 million CAPTCHAS executed daily
Free CAPTCHA service
30 million of these CAPTCHAS are solved daily
CAPTCHA words are scanned from old manuscripts
Solved CAPTCHAS actually digitize manuscripts

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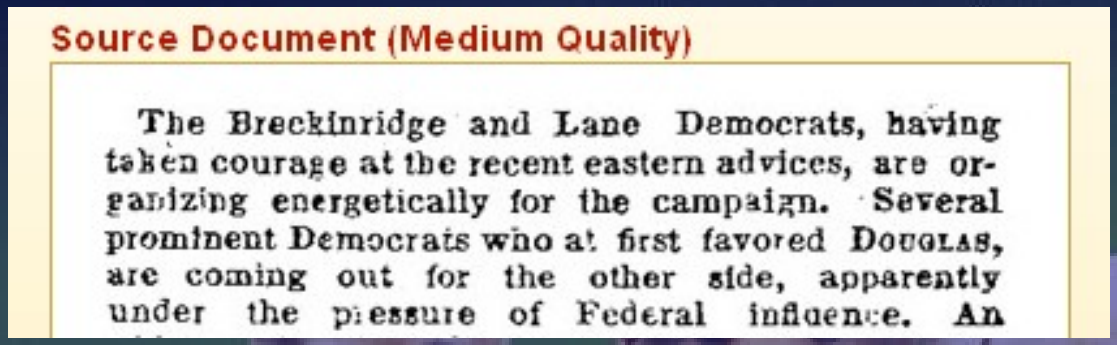
ReCAPTCHA Digitizing Success

Source Document (Medium Quality)



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OCR Transcription

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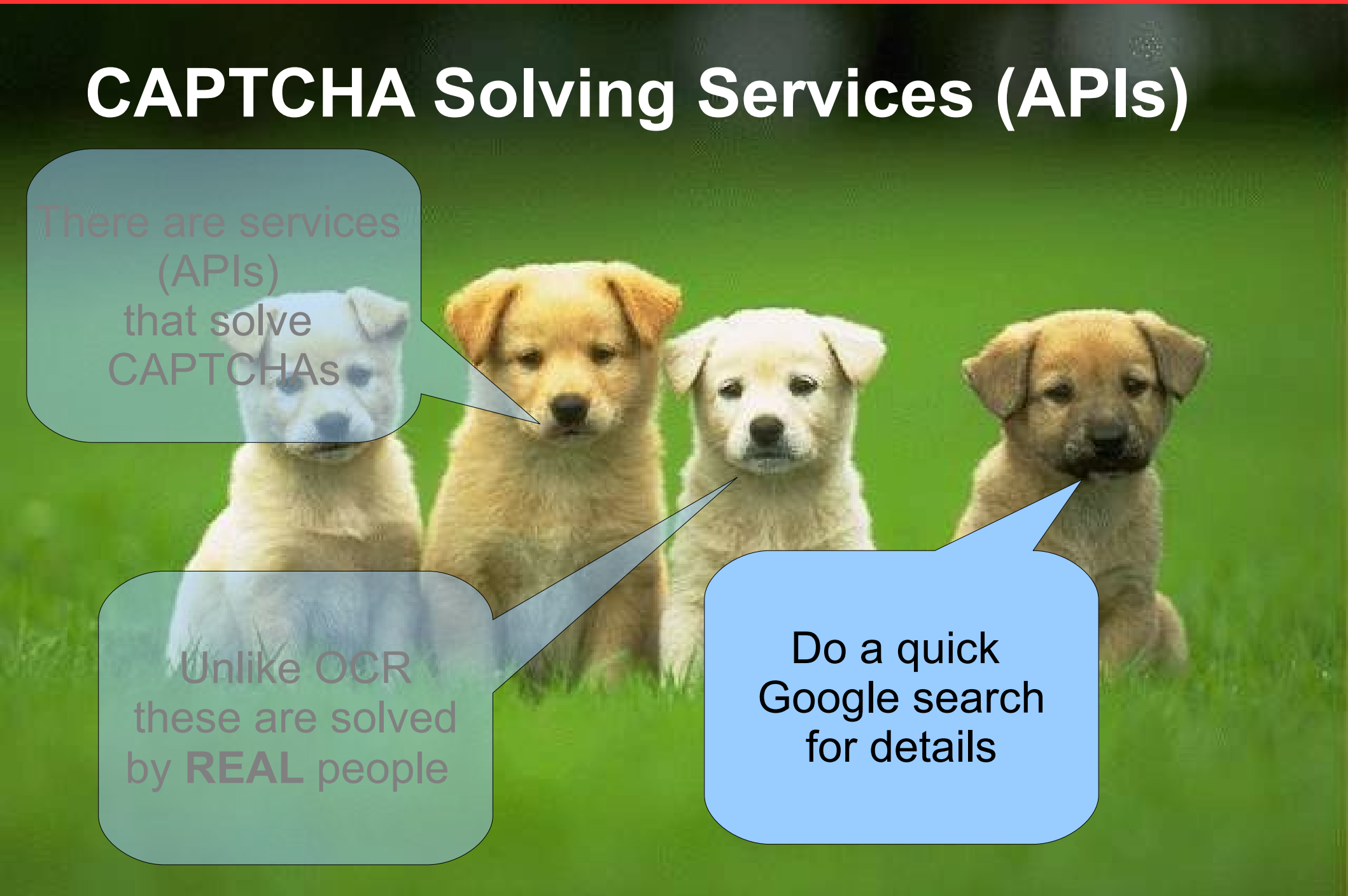
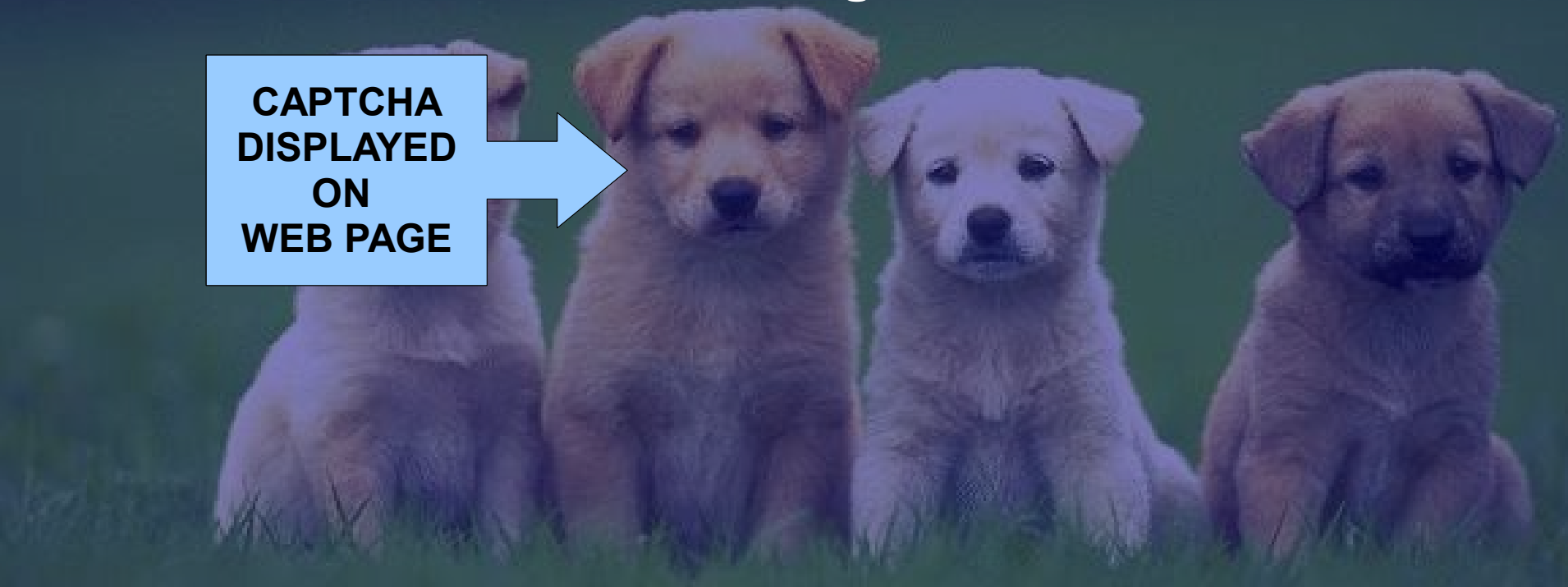


Heartwarming moment

There are CAPTCHA solving services



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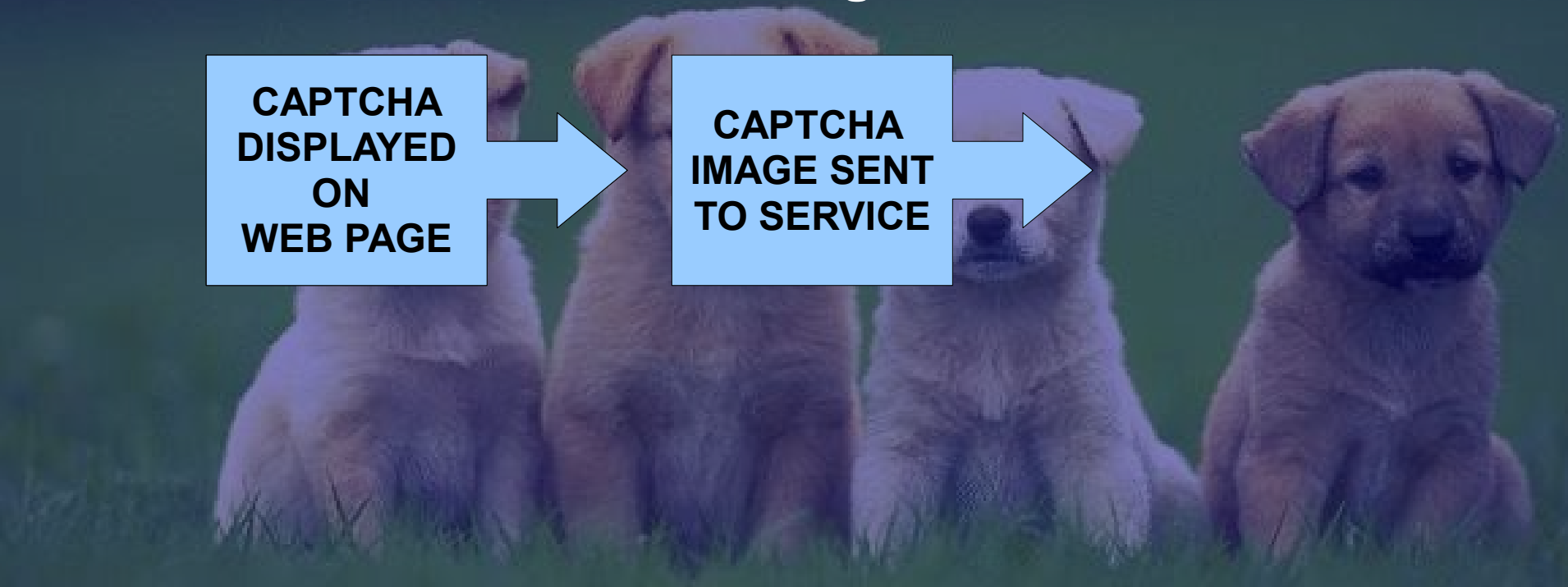

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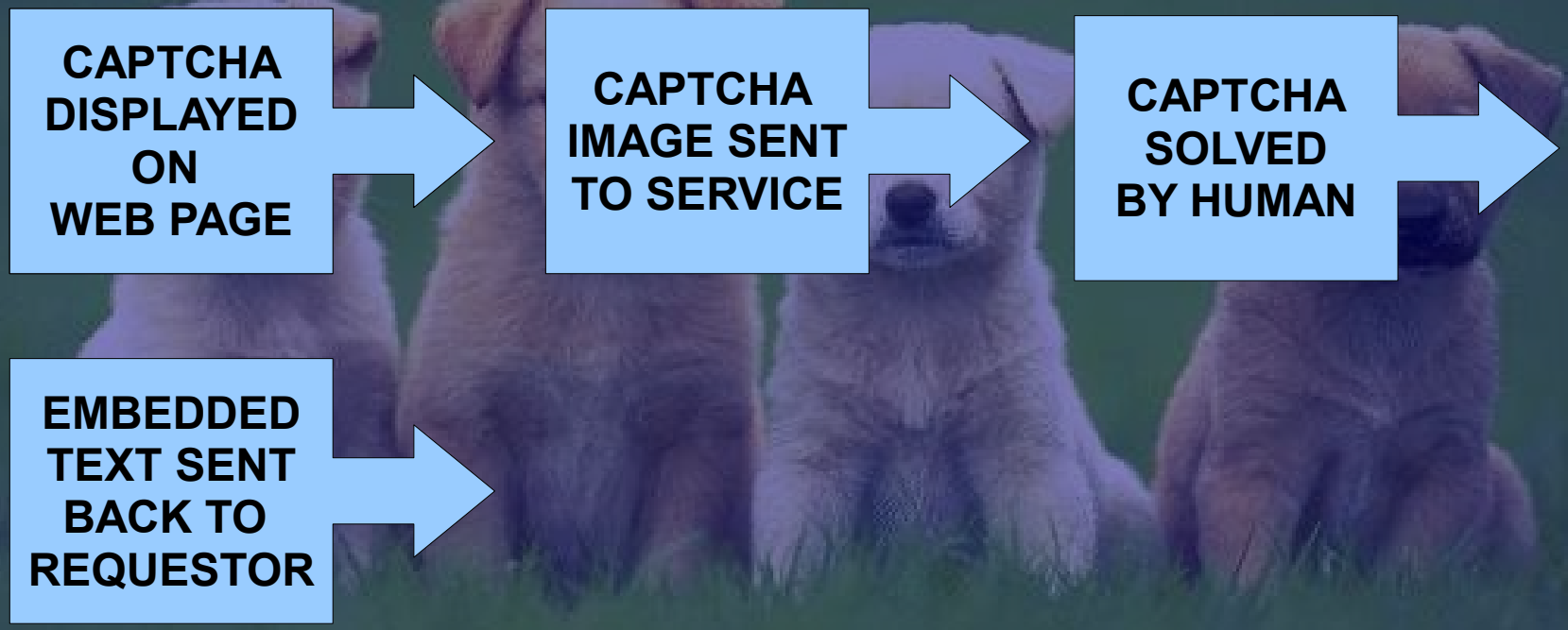

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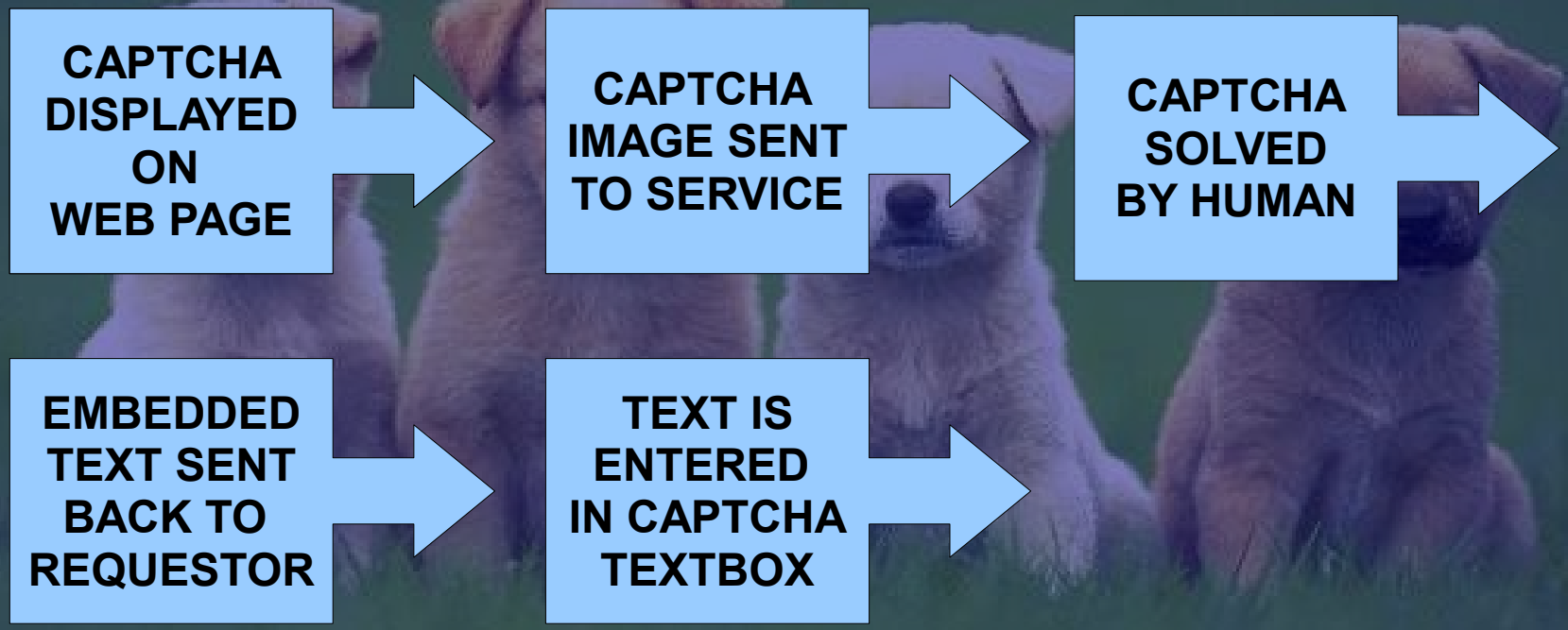

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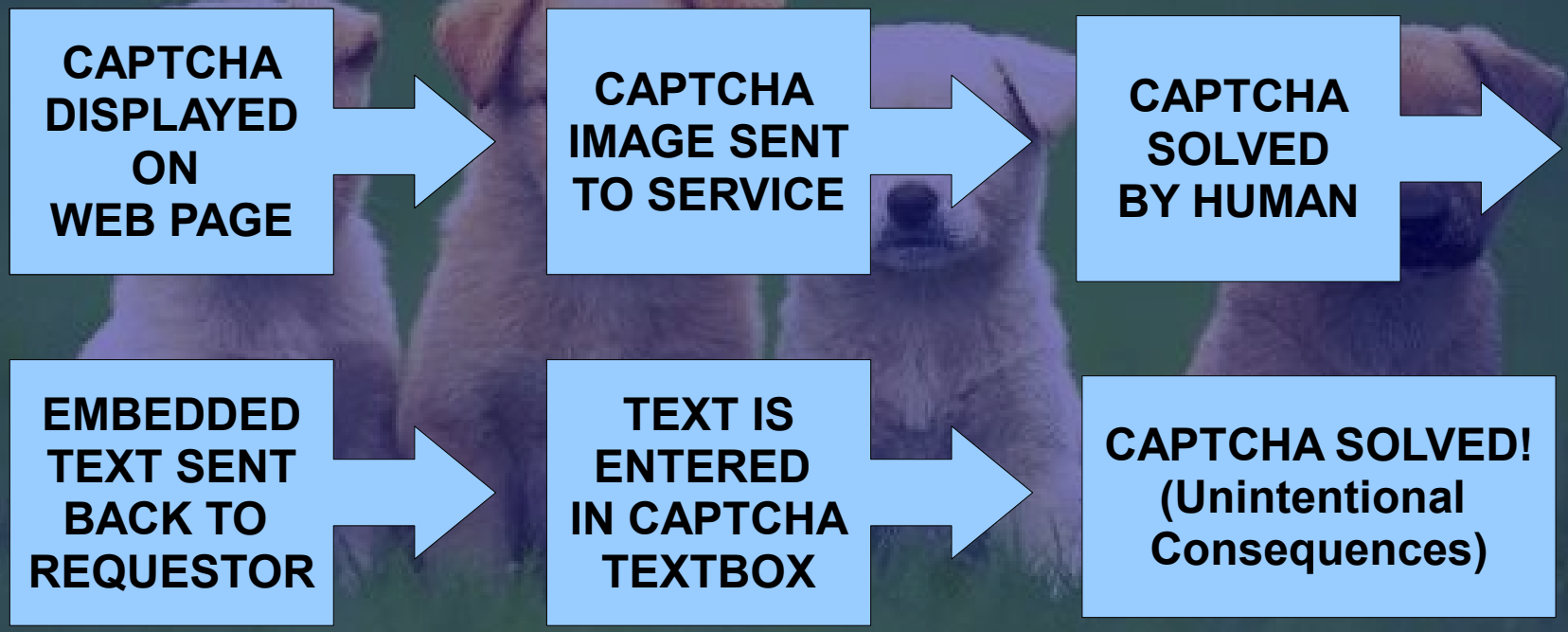

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Heartwarming moment

A FEEL GOOD WIN-WIN SITUATION!

There are CAPTCHA solving services

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PEOPLE IN DEVELOPING NATIONS HAVE JOBS

In conclusion

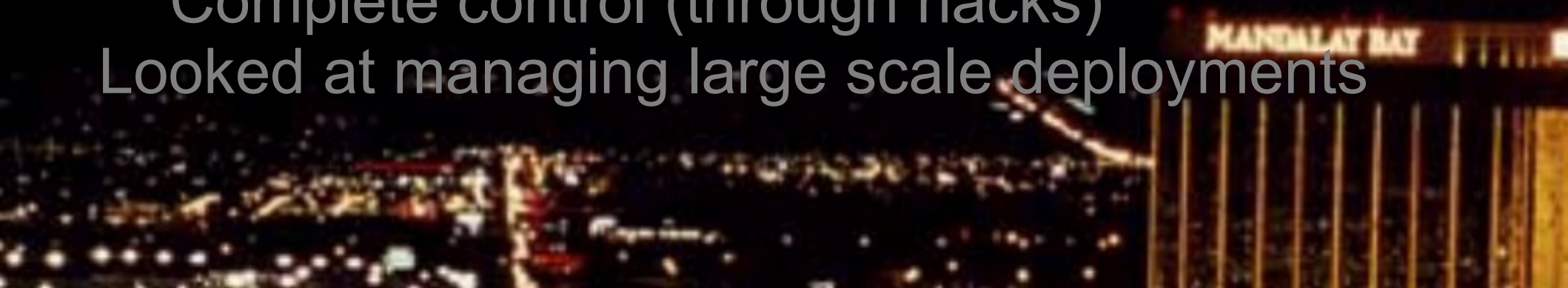
Review of traditional scraper theory

Described web design technologies and techniques that create “difficult cases” for webbot/screen scraper developers

Saw that iMacros can solve most (all) difficult cases by:

- Absolute browser emulation
- Complete control (through hacks)

Looked at managing large scale deployments



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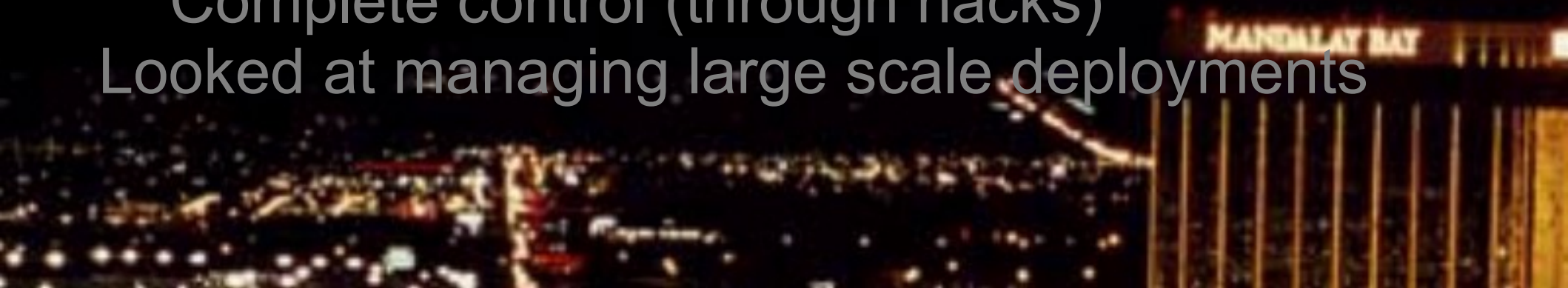

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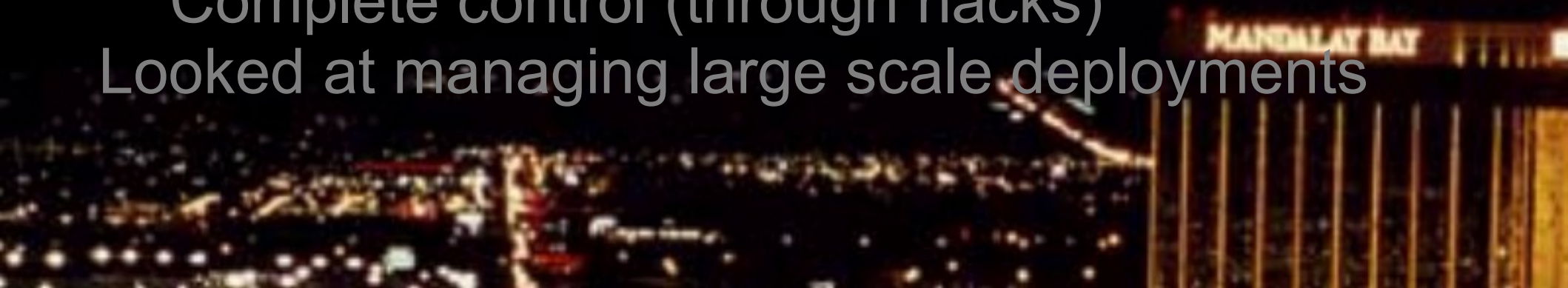

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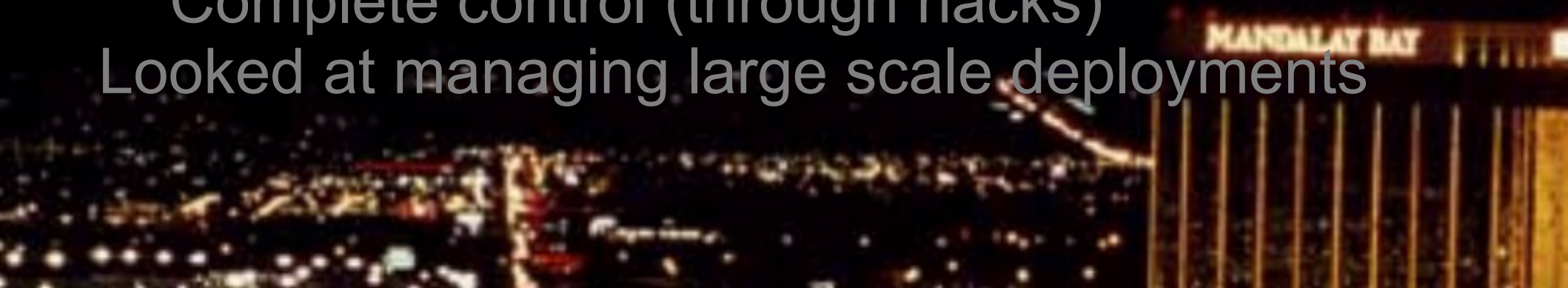

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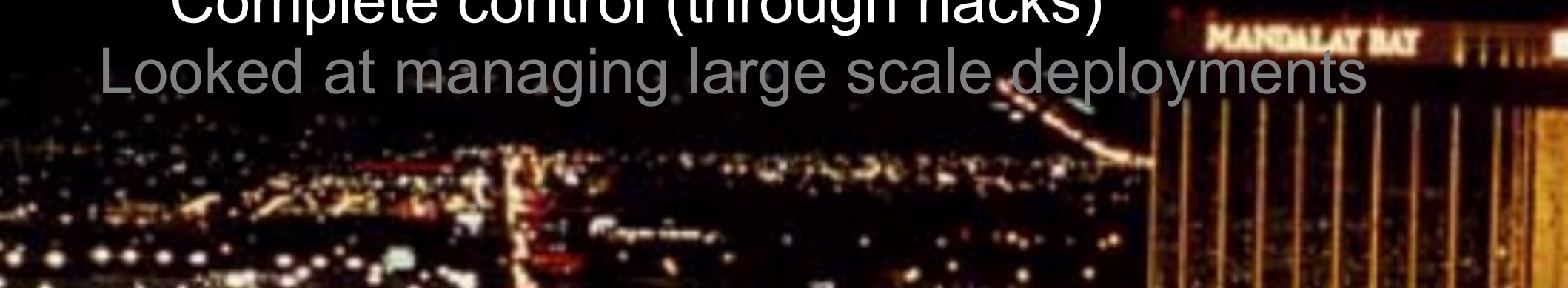

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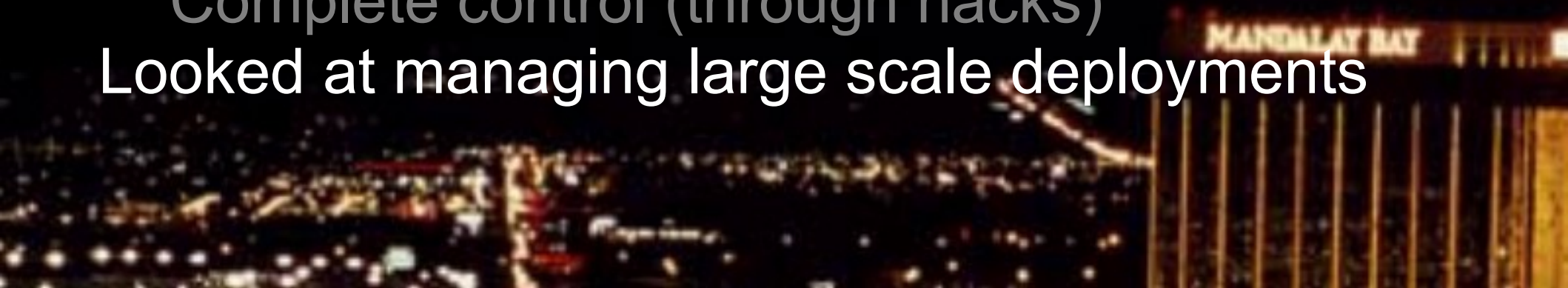

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Thank you!

Questions?

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