



# Web Security and You

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# About Security

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Do we really need to worry about this?

# Security? Bah!

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**Whether big or small.  
Someone will try to hack you!**

**It only takes one person!**

# The Open Web Application Security Project

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<http://owasp.org/>

The best online resource for learning about various attack vectors and solutions to them.

Use good judgement though, often wiki-user edited 'solutions'.

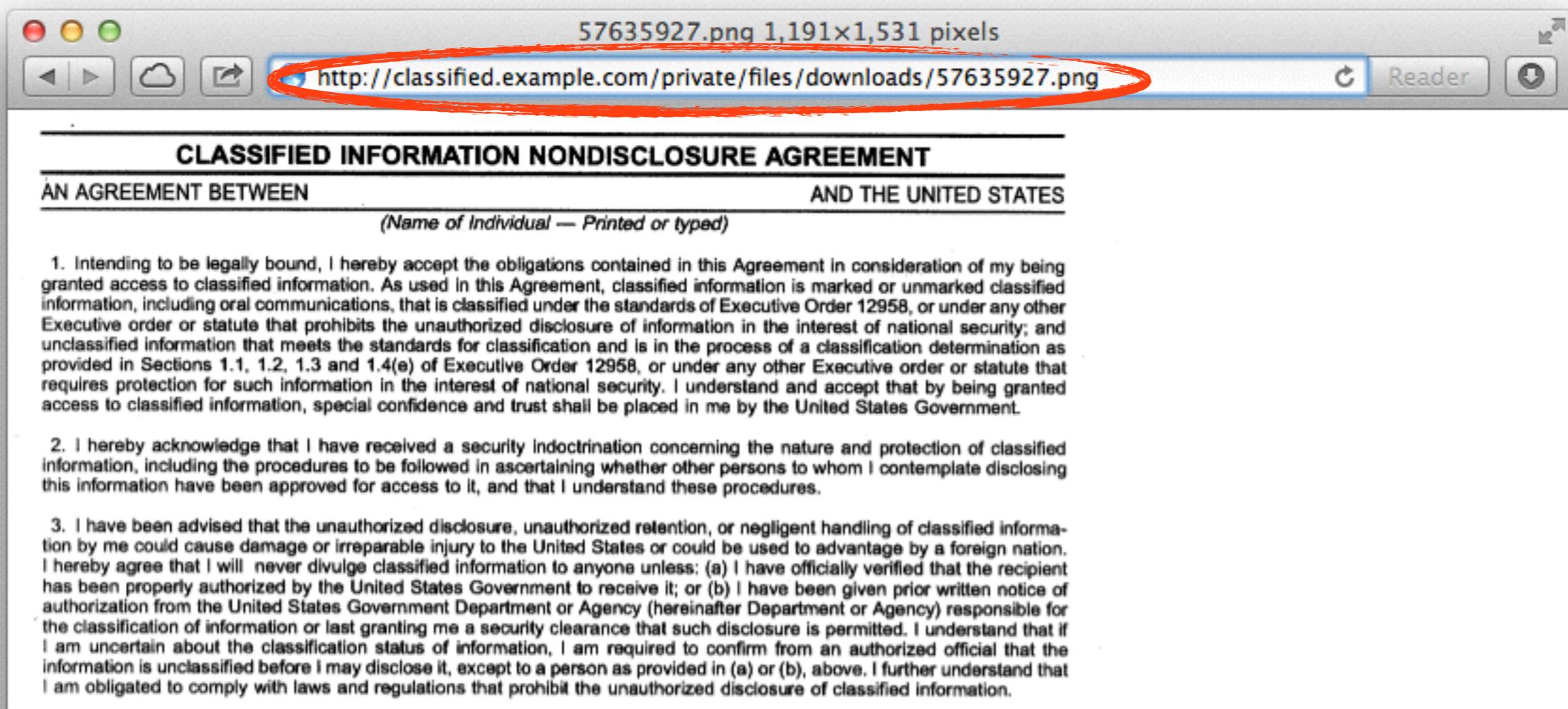
# Stupid Programmer Errors

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Let's clear the air on these first ...

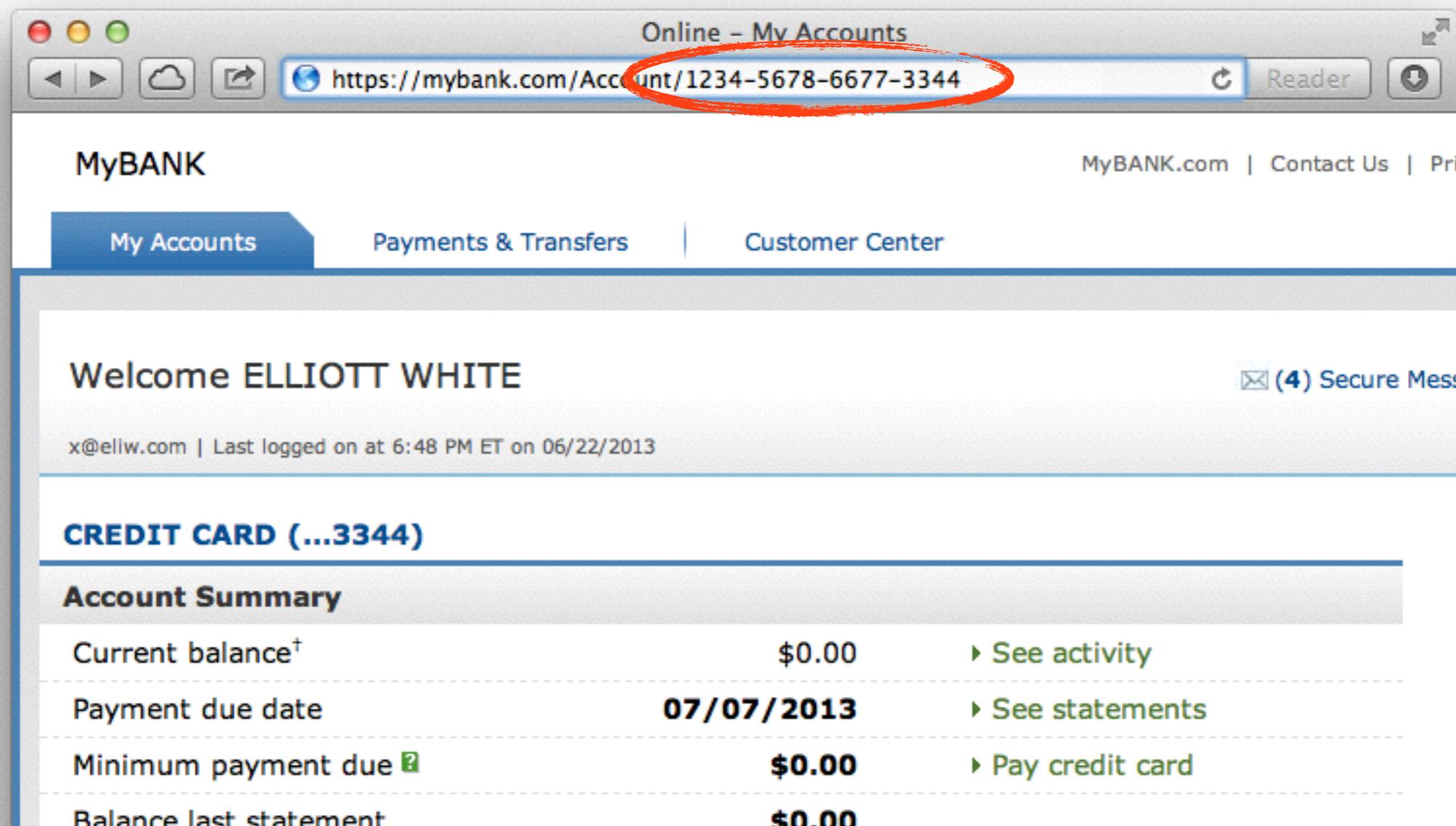
# Unchecked Permissions

## Direct URL access to a protected file



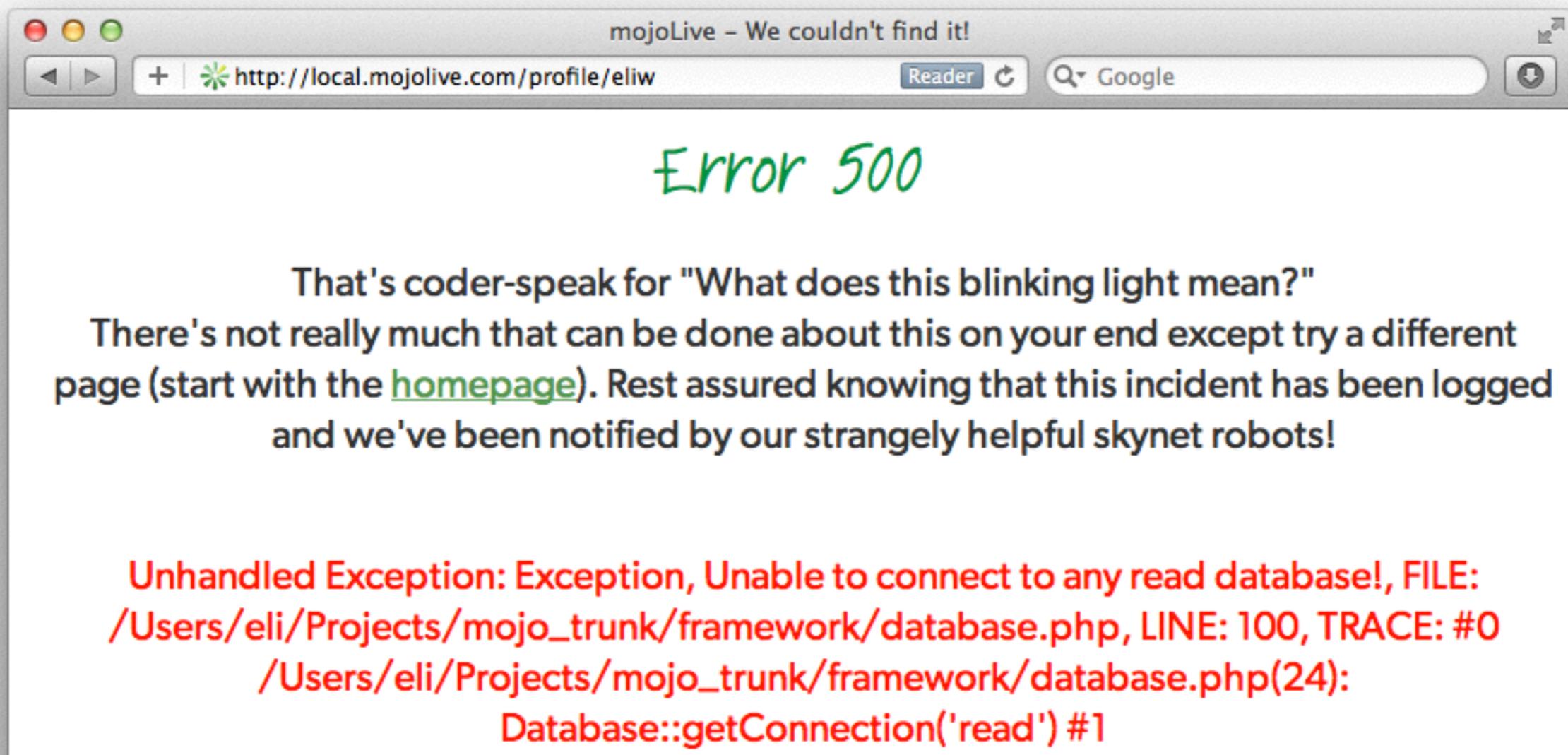
# Unchecked Permissions

Ability to URL-hack to access unauthorized data.



# Information leaks

## Specifically: Visible Error Handling



# Low Security Hashes (Encryption)

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**Don't just use MD5!**

So many other options:  
SHA512 SHA256 Blowfish etc!

Heck, even SHA1 is better!

Always salt your hashes!

# Various Attack Vectors

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Now moving on to true 'attacks' ...

# SQL Injection

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**A user having the ability to send data that is directly interpreted by your SQL engine.**

## The Security Hole:

```
$pdo->query("SELECT * FROM users  
          WHERE name = '{$_POST['name']}' AND pass = '{$_POST['pass']}'");
```

## The Attack:

```
$_GET['name'] = "' or 1=1; //";
```

# SQL Injection

**A user having the ability to send data that is directly interpreted by your SQL engine.**

## The Solution:

```
$query = $pdo->prepare("SELECT * FROM users WHERE name = ? AND pass = ?");  
$query->execute(array($_POST['name'], $_POST['pass']));
```

or

```
$name = $pdo->quote($_POST['name']);  
$pass = $pdo->quote($_POST['pass']);  
$pdo->query("SELECT * FROM users WHERE name = {$name} AND pass = {$pass}");
```

# Other Injection

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## **Command Injection:**

The user being able to inject code into a command line.

## **Unchecked File Uploads:**

The user being allowed to upload an executable file.

## **Code Injection:**

User being able to directly inject code. (DON'T USE EVAL!)

# Session Hijacking

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**One user 'becoming' another by taking over their session via impersonation.**

Avoid "Session Fixation"  
Don't use URL cookies for your sessions.

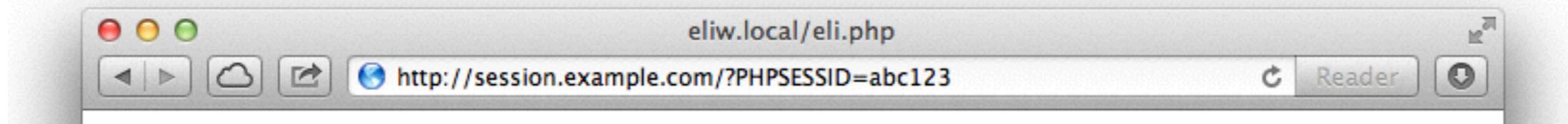
Always regenerate Session IDs  
on a change of access level.

Save an anti-hijack token to another cookie & session. Require it to be present & match. Salt on unique data (such as User Agent)

# Session Fixation

**A user being able to provide a known session ID to another user.**

## The Attack:



## The Solution:

```
session.use_cookies = 1  
session.use_only_cookies = 1  
session.cookie_httponly = 1
```

**Don't use URL cookies for your sessions.**

# Session Fixation (Take 2)

**Protect from more complicated fixation attacks, by regenerating sessions on change of access level.**

## The Solution:

```
session_start();  
if ($user->login($_POST['user'], $_POST['pass'])) {  
    session_regenerate_id(TRUE);  
}
```

and

```
session_start();  
$user->logout();  
session_regenerate_id(TRUE);
```

# Session Anti-Hijack Measures

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**Finally use anti-hijack measures to ensure user is legit**

## The Solution:

Not a few lines of code.  
Store whatever unique you can about this user/browser combination and verify it hasn't changed between loads.

Note that IP changes or can be shared.  
As happens with most other headers too.

# Session Anti-Hijack Measures

```
private function _sessionStart() {
    session_start();
    if (!empty($_SESSION)) { // Session not empty, verify:
        $token = $this->_hijackToken();
        $sh = empty($_SESSION['hijack']) ? NULL : $_SESSION['hijack'];
        $ch = empty($_COOKIE['data']) ? NULL : $_COOKIE['data'];
        if (!$sh || !$ch || ($sh != $ch) || ($sh != $token)) { // Hijacked!
            session_write_close();
            session_id(md5(time()));
            session_start();
            setcookie('data', 0, -172800);
            header("Location: http://www.example.com/");
        }
    } else { // Empty/new session, create tokens
        $_SESSION['started'] = date_format(new DateTime(), DateTime::ISO8601);
        $_SESSION['hijack'] = $this->_hijackToken();
        setcookie('data', $_SESSION['hijack']);
    }
}

private function _hijackToken() {
    $token = empty($_SERVER['HTTP_USER_AGENT']) ? 'N/A' : $_SERVER['HTTP_USER_AGENT'];
    $token .= '| Hijacking is Bad mmmkay? |'; // Salt
    $token .= $_SESSION['started']; // Random unique thing to this session
    return sha1($token);
}
```

# XSS (Cross Site Scripting)

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**A user sending data that is executed as script**

Many ways this attack can come in, but in all cases:  
**Everything** from a user is suspect (forms, user-agent, headers, etc)  
When fixing, escape to the situation (HTML, JS, XML, etc)  
**FIEO** (Filter Input, Escape Output)

Don't forget about rewritten URL strings!

# XSS - Reflected XSS

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## Reflected XSS

Directly echoing back content from the user

### The Security Hole:

```
<p>Thank you for your submission: <?=$_POST['first_name'] ?></p>
```

### The Attack:

First Name:

# XSS - Reflected XSS

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## Reflected XSS

Directly echoing back content from the user

### The Solution (HTML):

```
$name = htmlentities($_POST['first_name'], ENT_QUOTES, 'UTF-8', FALSE);
```

### The Solution (JS):

```
$name = str_replace(array("\r\n", "\r", "\n"),  
                    array("\n", "\n", "\\n"), addslashes($_POST['first_name']));
```

### The Solution (XML):

```
$name = iconv('UTF-8', 'UTF-8//IGNORE',  
             preg_replace("#[\x00-\x1f]#msi", ' ',  
             str_replace('&', '&amp;', $_POST['first_name']))));
```

# XSS - Stored XSS

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## Stored XSS

You store the data, then later display it

### The Security Hole:

```
<?php
$query = $pdo->prepare("UPDATE users SET first = ? WHERE id = 42");
$query->execute(array($_POST['first_name']));
?>
```

[...]

```
<?php
$result = $pdo->query("SELECT * FROM users WHERE id = 42");
$user = $result->fetchObject();
?>
<p>Welcome to <?= $user->first ?>'s Profile</p>
```

# XSS - Stored XSS

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## Stored XSS

You store the data, then later display it

### The Solution (HTML):

```
$name = htmlentities($user->first, ENT_QUOTES, 'UTF-8', FALSE);
```

### The Solution (JS):

```
$name = str_replace(array("\r\n", "\r", "\n"),  
                    array("\n", "\n", "\\n"), addslashes($user->first));
```

### The Solution (XML):

```
$name = iconv('UTF-8', 'UTF-8//IGNORE',  
             preg_replace("#[\\x00-\\x1f]#msi", ' ',  
             str_replace('&', '&amp;', $user->first))));
```

The Same!

# XSS - DOM XSS

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## DOM XSS

What happens in JavaScript, stays in JavaScript

### The Security Hole:

```
<script>
$('#verify').submit(function() {
    var first = $(this).find("input[name=first]").val();
    $(body).append("<p>Thanks for the submission: " + first + "</p>");
    return false;
});
</script>
```

# XSS - DOM XSS

## DOM XSS

What happens in JavaScript, stays in JavaScript

### The Solution (Simple):

```
<script>
function escapeHTML(str) {
  str = str + ""; var out = "";
  for (var i=0; i<str.length; i++) {
    if (str[i] === '<') { out += '&lt;'; }
    else if (str[i] === '>') { out += '&gt;'; }
    else if (str[i] === "'") { out += '&#39;'; }
    else if (str[i] === '"') { out += '&quot;'; }
    else { out += str[i]; }
  }
  return out;
}
</script>
```

But you have to deal with attr vs HTML vs CSS etc  
So use this: <https://github.com/chrisisbeef/jquery-encoder/>

# CSRF (Cross Site Request Forgery)

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**A user having the ability to forge or force a request on behalf of another user.**

**Simplistically via IMG tag or POST forms**

**Complicated via JavaScript**

# CSRF (Cross Site Request Forgery)

**A user having the ability to forge or force a request on behalf of another user.**

## The Attack:

```

```

or

```
<script>  
$.post({  
  url: 'http://quackr.example.com/quackit',  
  data: { msg: 'CSRF Attacks Rock!' }  
});  
</script>
```

# CSRF (Cross Site Request Forgery)

**Protect via CSRF token**

The Solution (on form):

```
<?php
function generateToken() {
    $token = empty($_SESSION['token']) ? false : $_SESSION['token'];
    $expires = empty($_SESSION['tExpires']) ? false : $_SESSION['tExpires'];
    if (!$token || ($expires < time())) {
        $token = md5(uniqid(mt_rand(), true));
        $_SESSION['token'] = $token;
    }
    $_SESSION['tokenExpires'] = time() + 14400;
    return $token;
}
?>
<form method="POST" action="">
    <input name="msg" value="" />
    <input type="hidden" name="token" value="<?= generateToken() ?>" />
    <input type="submit" />
</form>
```

# CSRF (Cross Site Request Forgery)

**Protect via CSRF token**

## The Solution (on submission):

```
<?php
$token = empty($_SESSION['token']) ? false : $_SESSION['token'];
$expires = empty($_SESSION['tExpires']) ? false : $_SESSION['tExpires'];
$check = empty($_POST['token']) ? false : $_POST['token'];

if ($token && ($token == $check) && ($expires > time())) {
    // SUCCESS - Process the form
} else {
    // FAILURE - Block this:
    header('HTTP/1.0 403 Forbidden');
    die;
}
?>
```

# Clickjacking

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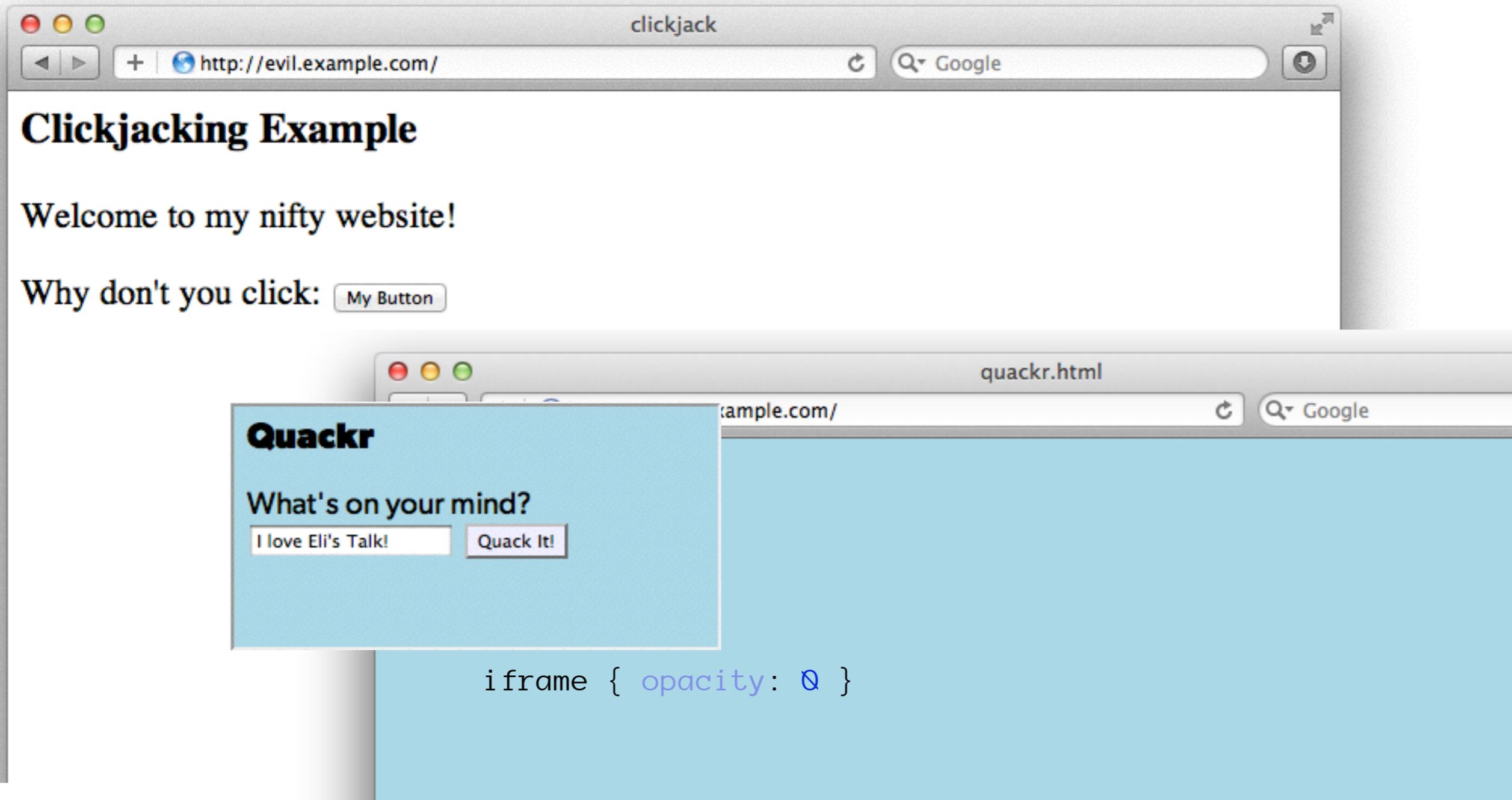
**One of the newest threats**

Lots of publicity when Twitter was hit

Tricks user into physically making a click on the remote website without realizing it, getting around any CSRF protection.

**Watch a demo:**

# Clickjacking



# Clickjacking - Solution 1

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**Use specific header, to disallow site framing:**

The Solution:

```
header('X-Frame-Options: DENY');
```

or

```
header('X-Frame-Options: SAMEORIGIN');
```

**Doesn't work in all browsers!**

Became IETF standard RFC 7034 in October 2013

# Clickjacking - Solution 2

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**Ensure you aren't displayed in iFrame**

## The Solution:

```
<html>
  <head>
    <style> body { display : none;} </style>
  </head>
  <body>
    <script>
      if (self == top) {
        var theBody = document.getElementsByTagName( 'body' )[0];
        theBody.style.display = "block";
      } else {
        top.location = self.location;
      }
    </script>
  </body>
</html>
```

# Brute Force Attacks (Password)

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Really only two primary defenses:

**CAPTCHA**

**IP rate limiting**

# Brute Force Attacks (CAPTCHA)

reCAPTCHA is free and easy to use



## On the Form:

```
<?php require_once('recaptchalib.php'); ?>
<form method="POST" action="">
  <label>Username: <input name="user" /></label><br />
  <label>Password: <input name="pass" type="password" /></label><br />
  <?= recaptcha_get_html("YOUR-PUBLIC-KEY"); ?>
  <input type="submit" />
</form>
```

# Brute Force Attacks (CAPTCHA)

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## On the Server:

```
<?php
require_once('recaptchalib.php');
$check = recaptcha_check_answer(
    "YOUR-PRIVATE-KEY", $_SERVER["REMOTE_ADDR"],
    $_POST["recaptcha_challenge_field"], $_POST["recaptcha_response_field"]);

if (!$check->is_valid) {
    die("INVALID CAPTCHA");
} else {
    // Yay, it's a human!
}
?>
```

<https://developers.google.com/recaptcha/docs/php>

# Brute Force Attacks (Rate Limit)

**Only allow so many fails per IP**

## The Solution:

```
$blocked = false;
$cachekey = 'attempts.' . $_SERVER['REMOTE_ADDR'];
$now = new DateTime();
$attempts = $memcached->get($cachekey) ?: [];
if (count($attempts) > 4) {
    $oldest = new DateTime($attempts[0]);
    if ($oldest->modify('+5 minute') > $now) {
        $blocked = true; // Block them
    }
}
if (!$blocked && $user->login()) {
    $memcached->delete($cachekey);
} else {
    array_unshift($attempts, $now->format(DateTime::ISO8601));
    $attempts = array_slice($attempts, 0, 5);
    $memcached->set($cachekey, $attempts);
}
```

# Server Level Security

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Now moving on to true 'attacks' ...

# Keep Your Stack Patched

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**No excuses. Keep all your software up to date!**

**Linux**

**Apache**

**MySQL**

**Ruby**

**Python**

**PHP**

# DDOS & Similar Attacks

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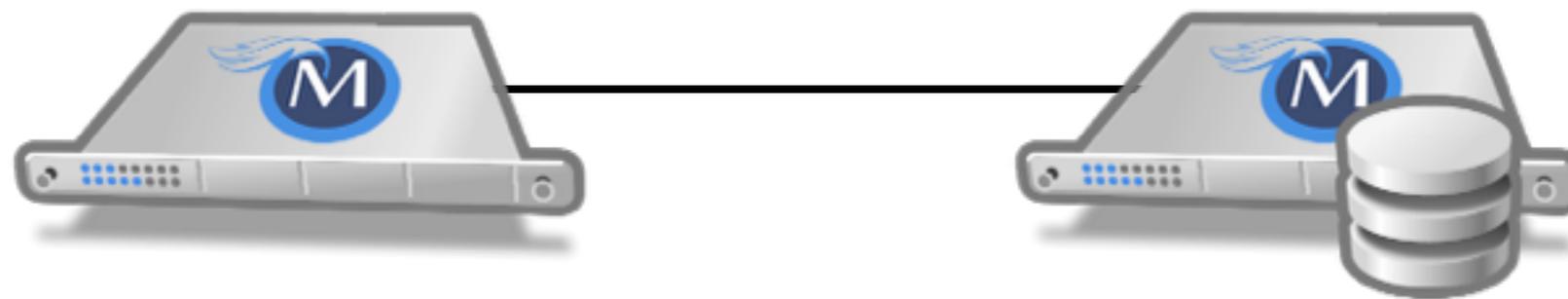
**Good luck!**

**Rely on firewall features of  
your machines & hosting.**

**Hire a good ops team**

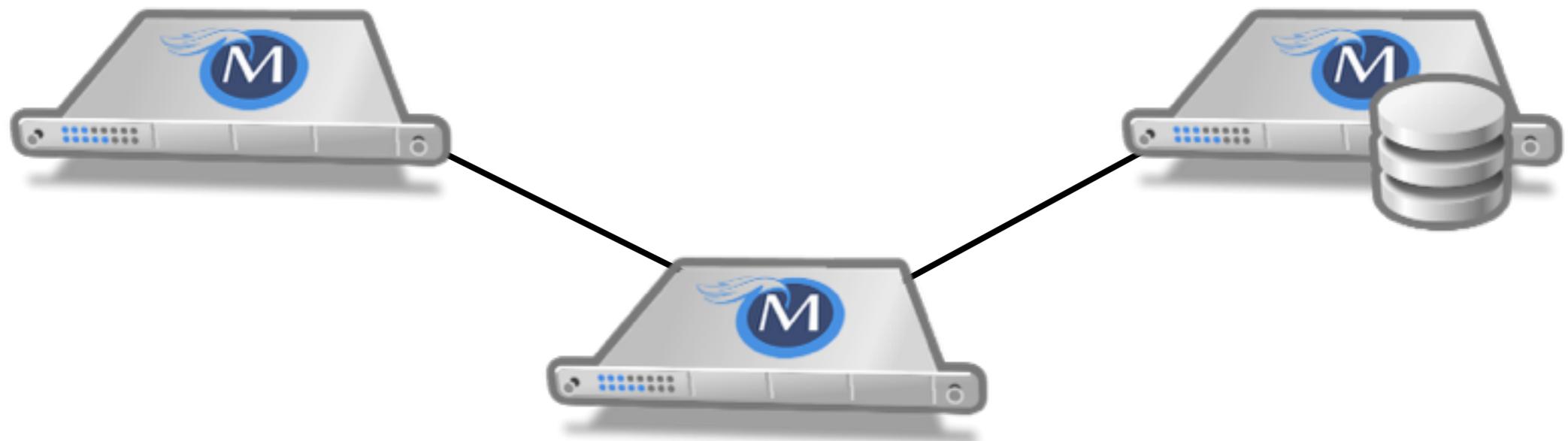
# Man in the Middle

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# Man in the Middle

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The Solution: Use SSL

# Brief Commercial Interruption...

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Back in Print!

# Questions?

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