```
 ______   __        ________  ______   ___   ___   _________  ________   ______   ___   ___   ________  ___   __    _______
/_____/\ /_/\      /_______/\/_____/\ /___/\/__/\ /________/\/_______/\ /_____/\ /___/\/__/\ /_______/\/__/\ /__/\ /______/\
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   \:\_\ \ \\:\/___/\/__\::\__/\\:\_\ \ \\: \ )  \ \ \: \  \ \  \:.\ \  \ \\:\_\ \ \\: \ )  \ \/__\::\__/\\. \`-\  \ \\:\_\ \ \
    \_____\/ \_____\/\________\/ \_____\/ \__\/\__\/  \_____\/   \__\/\__\/ \_____\/ \__\/\__\/\________\/ \__\/ \__\/ \_____\/
```

Clickjacking (UI Redress)

- When the attacker uses multiple transparent or opaque layers to trick a user into clicking on a button or link on another page when they were intending to click on the top level page
- Clicks are “hijacked” and routed to another page
- You can kind of think of it as a more involved and more “physical” CSRF attack

Example

- Assumption: victim is logged into social network
- Imagine a page with a "click to view embarrassing photos" link
- On top of that page (and invisible to the user) the attack has loaded an iFrame with their page on a social network
- The attacker lines up the "add friend" button on their profile page up with the "click to view" link
- When the user clicks to view the embarrassing photos they are actually clicking the "add friend" button
- The user is tricked into adding the attacker as their friend on the social network

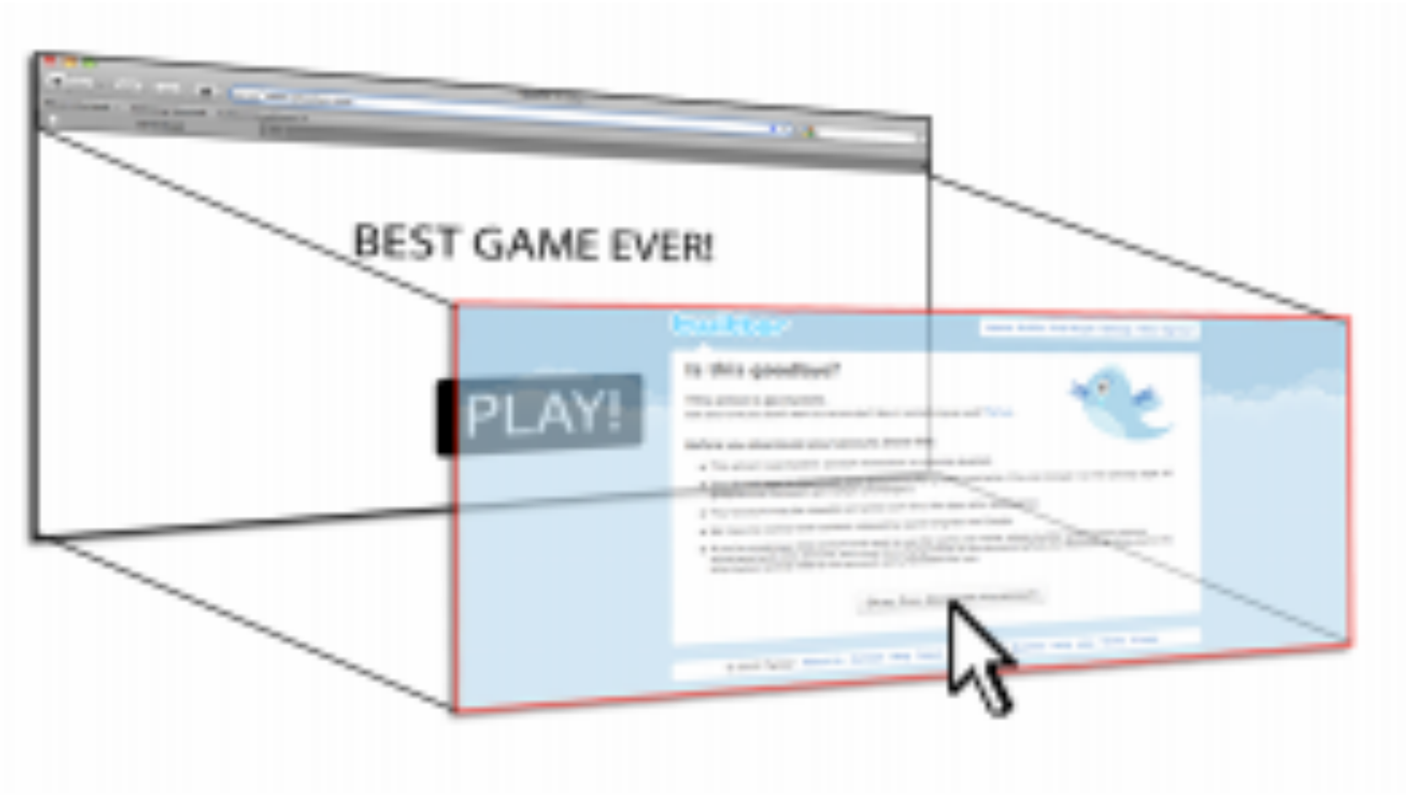
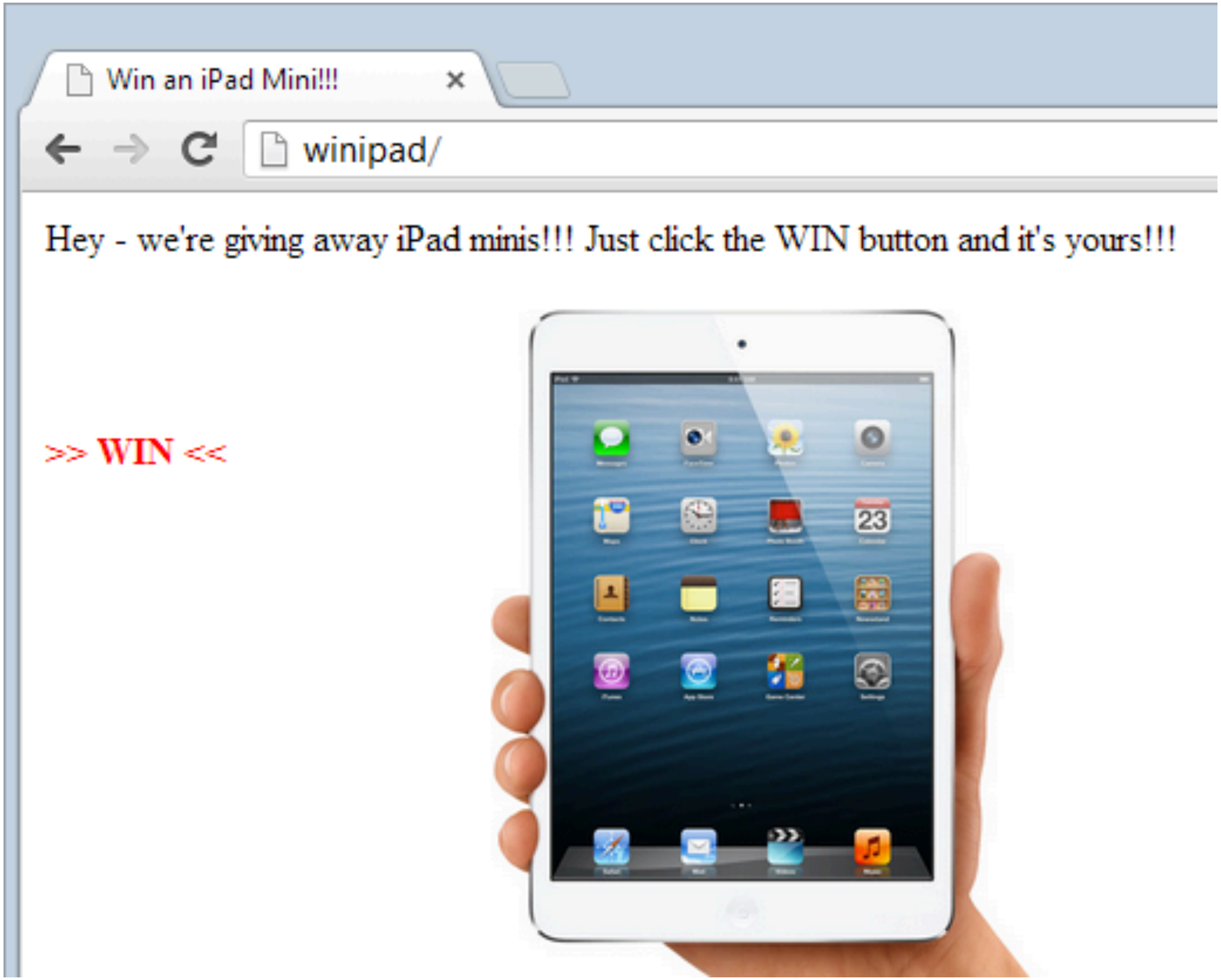
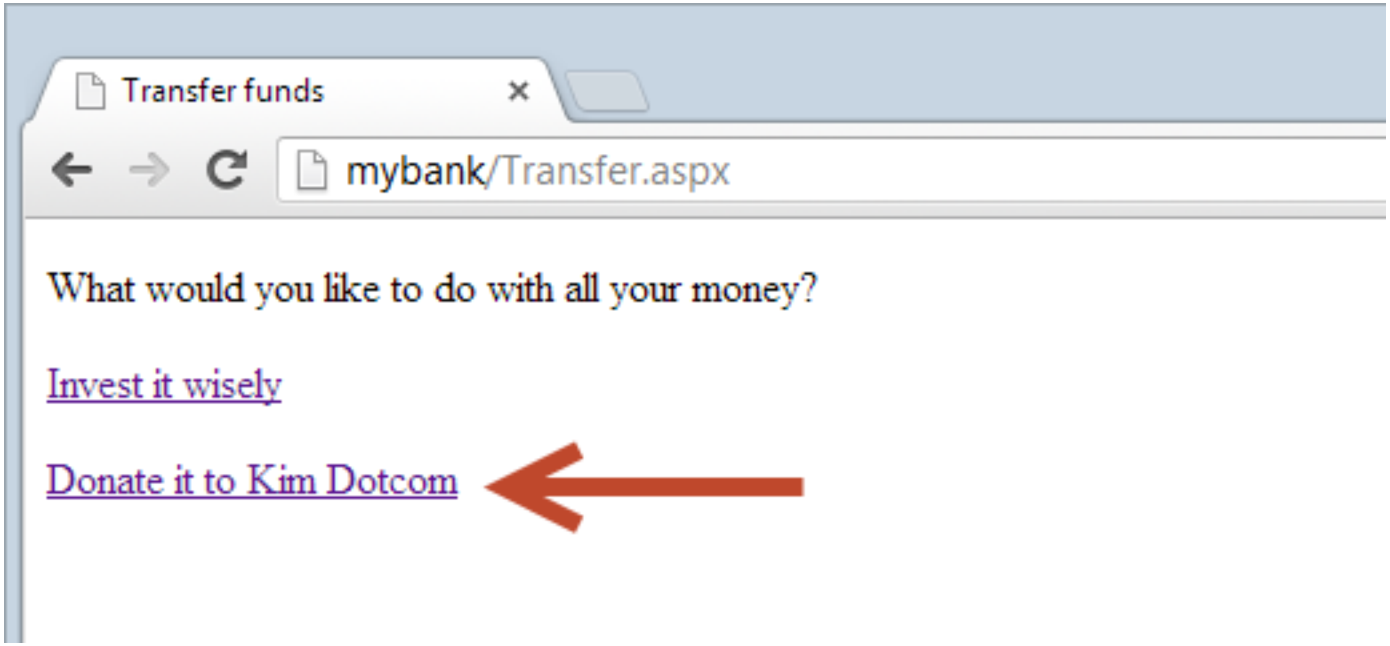


Figure 1: Visualization of a clickjacking attack on Twitter's account deletion page.



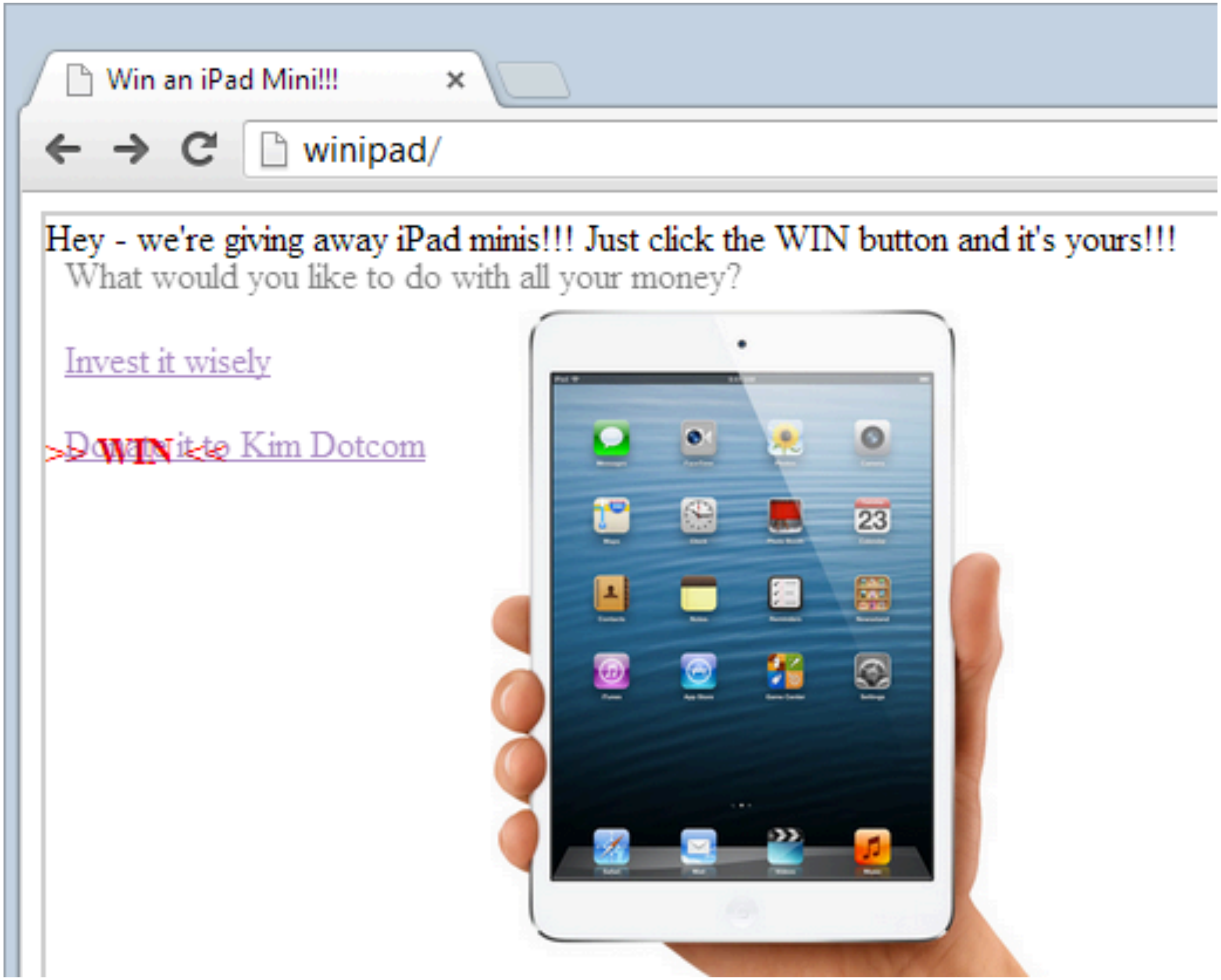
Hey - we're giving away iPad minis!!! Just click the WIN button and it's yours!!!



What would you like to do with all your money?

Invest it wisely

Donate it to Kim Dotcom



Hey - we're giving away iPad minis!!! Just click the WIN button and it's yours!!!

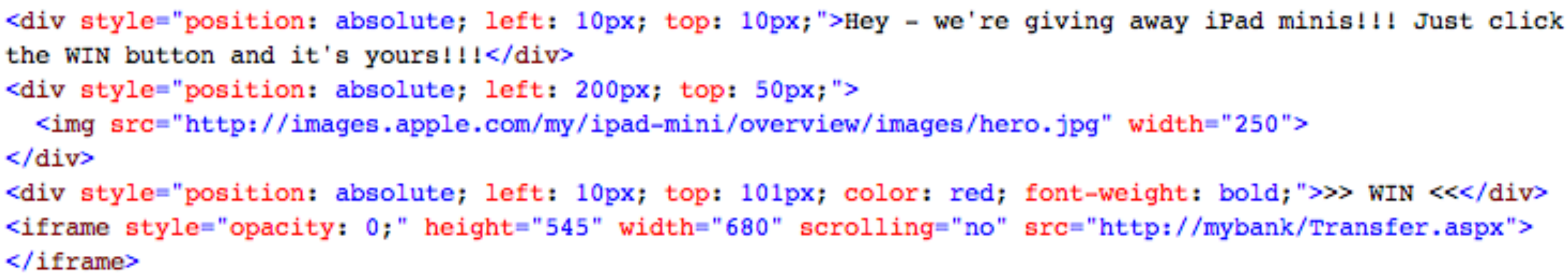
What would you like to do with all your money?

Invest it wisely

Donate it to Kim Dotcom

>>WIN<<

Code Example



```
<div style="position: absolute; left: 10px; top: 10px;">Hey - we're giving away iPad minis!!! Just click
the WIN button and it's yours!!!</div>
<div style="position: absolute; left: 200px; top: 50px;">
  <img src="http://images.apple.com/my/ipad-mini/overview/images/hero.jpg" width="250">
</div>
<div style="position: absolute; left: 10px; top: 101px; color: red; font-weight: bold;">>> WIN <<</div>
<iframe style="opacity: 0;" height="545" width="680" scrolling="no" src="http://mybank/Transfer.aspx">
</iframe>
```

Two Main Defenses

- X-Frame-Options HTTP response header
- Framebusting UI code

X-Frame-Options header

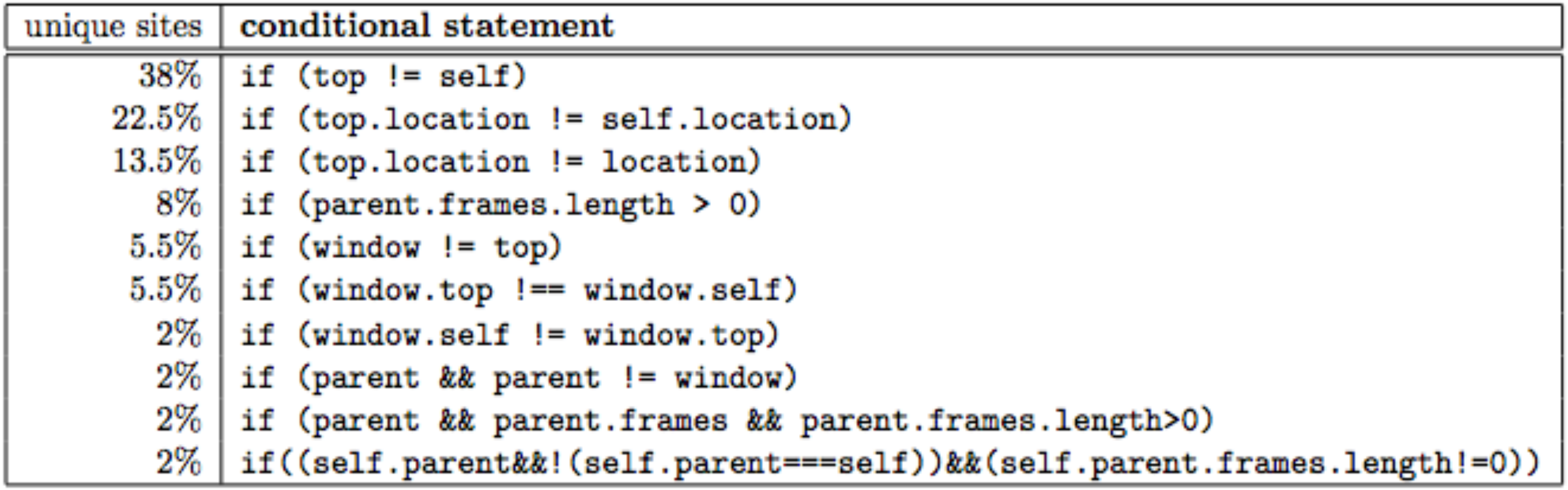
- The only “real” solution
- Tells the browser whether a requested page can be framed
- Can be tweaked per page
- Three values:
  - DENY - no framing period
  - SAMEORIGIN - can only be framed in the same domain
  - ALLOW-FROM - can only be framed by trusted pages

Framebusting UI code

- Check to see if the page is same as the one loaded from the address bar

```
if (top.location != location) {
  top.location = self.location;
}
```

Common Defenses



unique sites	conditional statement
38%	if (top != self)
22.5%	if (top.location != self.location)
13.5%	if (top.location != location)
8%	if (parent.frames.length > 0)
5.5%	if (window != top)
5.5%	if (window.top !== window.self)
2%	if (window.self != window.top)
2%	if (parent && parent != window)
2%	if (parent && parent.frames && parent.frames.length>0)
2%	if((self.parent&&!(self.parent===self))&&(self.parent.frames.length!=0))

Table 2: Frame busting conditional statement

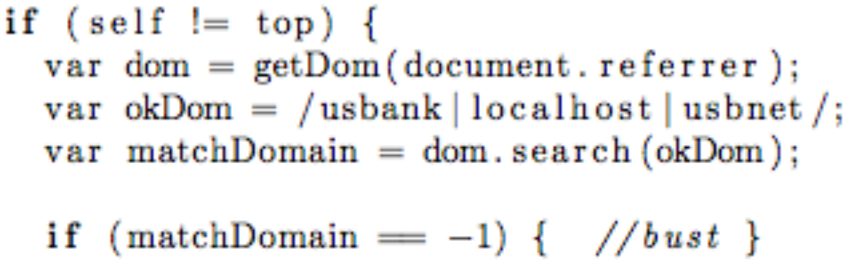
Can anyone think of bypasses to these?

Framebusting Arms Race

- Frame buster busters such as:
  - Nesting the victim site in two frames as the double framing causes the descendent frame navigation policy to disable redirection
  - Tapping into the onBeforeUnload event to cancel the redirection (albeit with some user input) when the frame buster attempts to unload the page
  - Exploiting XSS filters designed to prohibit Cross-Site Scripting in order to cancel out the frame buster

Can you think of a bypass?

USBank framebusting



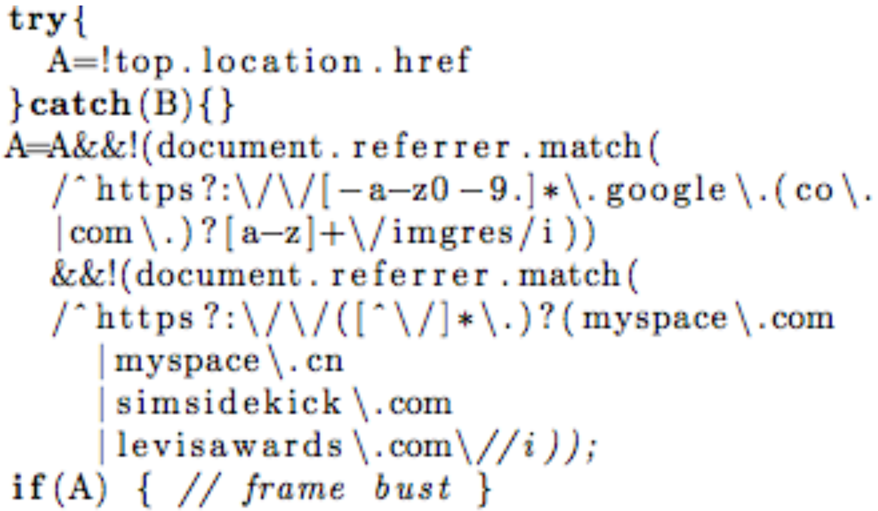
```
if (self != top) {
  var dom = getDom(document.referrer);
  var okDom = /usbank|localhost|usbnet/;
  var matchDomain = dom.search(okDom);

  if (matchDomain == -1) {  //bust }
```

USBank framebusting issues

- Still allows domains with the word usbank in it
- Can be framed by:
  - http://www.husbanken.no
  - http://www.rusbank.org
  - Or any domain registered by an attacker with usbank in it

Myspace framebusting



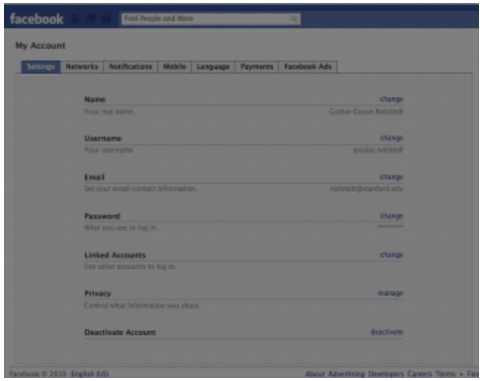
```
try{
  A=!top.location.href
}catch(B){}
A=A&&!(document.referrer.match(
  /^https?:\/\/[-a-z0-9.]*\.google\.(co\.
  |com\.)?[a-z]+\/imgres/i))
  &&!(document.referrer.match(
  /^https?:\/\/([^\/]*\.)?(myspace\.com
     |myspace\.cn
     |simsidekick\.com
     |levisawards\.com\//i));
if(A) { // frame bust }
```

Myspace framebusting issues

- Allows for framing by Google images
- Google images does not employ frame busting
- An attack simply frames Google images and then cause Google images to frame Myspace

A Clever Clickjacking Protection

- Facebook.com inserts a gray semi-transparent div that covers all of the content when a profile page is framed
- Allows framing but blocks clickjacking attacks



My Account

Name
Your real name. Gustav Goose Rydstedt

Username
Your username gustav.rydstedt

Email
Set your email contact information. rydstedt@stanford.edu

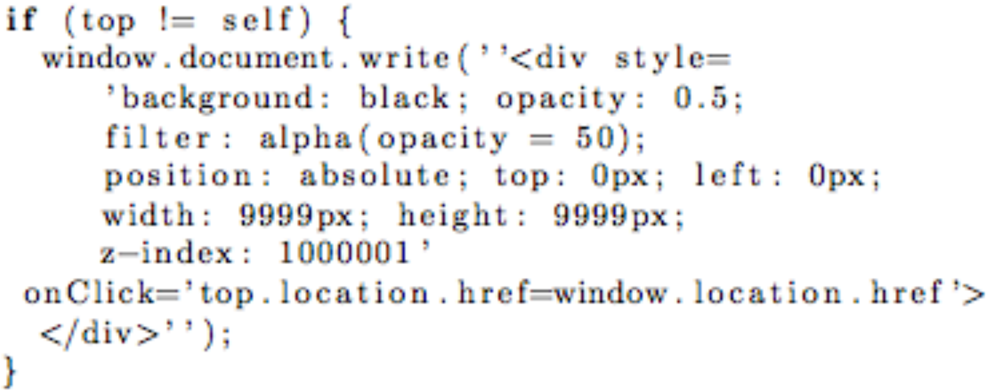
Password
What you use to log in. ********

Linked Accounts
Use other accounts to log in.

Privacy
Control what information you share.

Deactivate Account

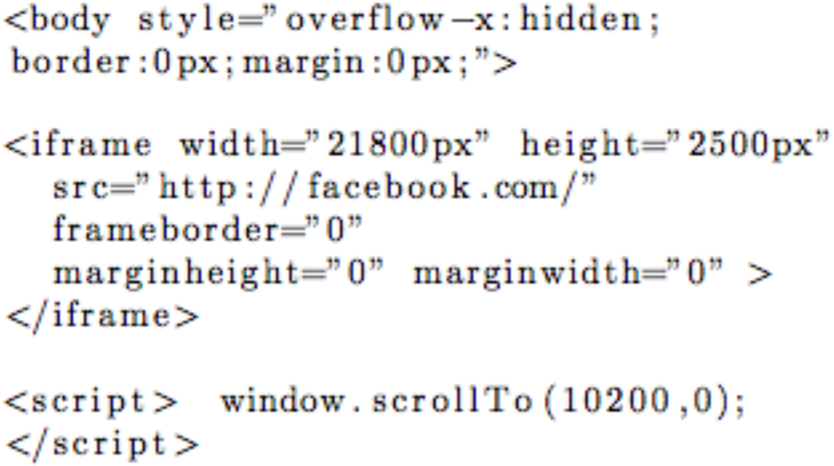
Facebook © 2010



```
if (top != self) {
  window.document.write(''<div style=
      'background: black; opacity: 0.5;
      filter: alpha(opacity = 50);
      position: absolute; top: 0px; left: 0px;
      width: 9999px; height: 9999px;
      z-index: 1000001'
 onClick='top.location.href=window.location.href'>
  </div>'');
}
```

Facebook.com bypass

- Make the enclosing frame so large that the center of the frame is outside of the dark div
- The content centers itself automatically
- The scrollTo function dynamically scrolls to the center



```
<body style=”overflow−x:hidden;
 border:0px;margin:0px;”>

<iframe width=”21800px” height=”2500px”
   src=”http://facebook.com/”
   frameborder=”0”
   marginheight=”0” marginwidth=”0” >
</iframe>

<script> window.scrollTo(10200,0);
</script>
```

Resources

- http://www.troyhunt.com/2013/05/clickjack-attack-hidden-threat-right-in.html
- http://seclab.stanford.edu/websec/framebusting/framebust.pdf
- https://www.owasp.org/index.php/Clickjacking