CSE 484 (Winter 2010)

Web Security

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Goals for Today

- Web security

WSJ.com circa 1999 [due to Fu et al.]

- Idea: use user,hash(user||key) as authenticator
  - Key is secret and known only to the server. Without the key, clients can't forge authenticators.
  - || is string concatenation
- Implementation: user,crypt(user||key)
  - crypt() is UNIX hash function for passwords
  - crypt() truncates its input at 8 characters
  - Usernames matching first 8 characters end up with the same authenticator
  - No expiration or revocation
- It gets worse… This scheme can be exploited to extract the server's secret key

Attack

username	crypt(username,key,"00")	authenticator cookie
AliceBob1	008H8LRfzUXvk	AliceBob1008H8LRfzUXvk
AliceBob2	008H8LRfzUXvk	AliceBob2008H8LRfzUXvk

"Create" an account with a 7-letter user name…

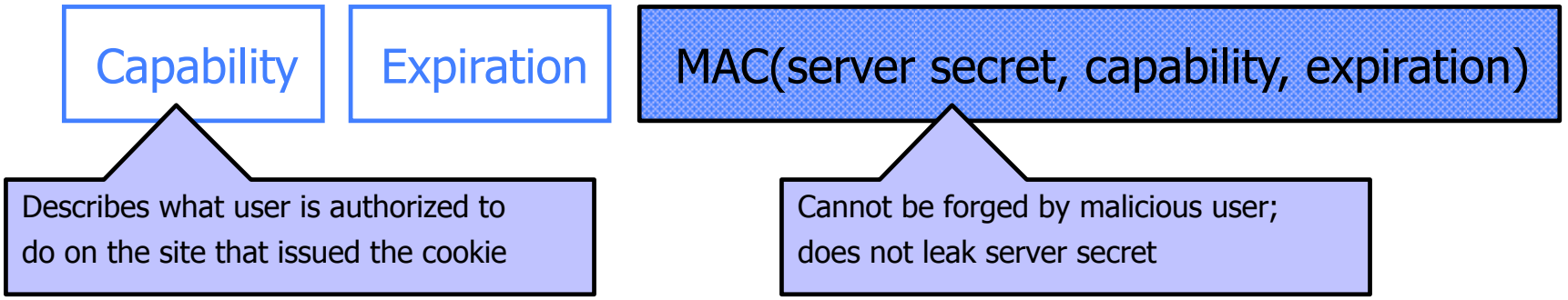
AliceBoA	0073UYEre5rBQ	Try logging in: access refused
AliceBoB	00bkHcfOXBKno	Access refused
AliceBoC	00ofSJV6An1QE	Login successful! 1st key symbol is C

Now a 6-letter user name…

AliceBCA	001mBnBErXRuc	Access refused
AliceBCB	00T3JLLfuspdo	Access refused… and so on

- Only need 128 x 8 queries instead of intended 128^8
- Minutes with a simple Perl script vs. billions of years

Better Cookie Authenticator



- Main lesson: be careful rolling your own
  - Homebrewed authentication schemes are easy to get wrong
- There are standard cookie-based schemes

Web Applications

- Online banking, shopping, government, etc.
- Website takes input from user, interacts with back-end databases and third parties, outputs results by generating an HTML page
- Often written from scratch in a mixture of PHP, Java, Perl, Python, C, ASP, ...
- Security is a potential concern.
  - Poorly written scripts with inadequate input validation
  - Sensitive data stored in world-readable files

JavaScript

- Language executed by browser
  - Can run before HTML is loaded, before page is viewed, while it is being viewed or when leaving the page
- Often used to exploit other vulnerabilities
  - Attacker gets to execute some code on user's machine
  - Cross-scripting: attacker inserts malicious JavaScript into a Web page or HTML email; when script is executed, it steals user's cookies and hands them over to attacker's site
  - Risks to doing "input validation" on client within JavaScript

Scripting

```
<script type="text/javascript">
    function whichButton(event) {
            if (event.button==1) {
                    alert("You clicked the left mouse button!") }
            else {
                    alert("You clicked the right mouse button!")
            }}
</script>
…
<body onMouseDown="whichButton(event)">
…
</body>
```

Script defines a page-specific function

Function gets executed when some event happens (onLoad, onKeyPress, onMouseMove…)

JavaScript Security Model

- Script runs in a "sandbox"
  - Not allowed to access files or talk to the network
- Same-origin policy
  - Can only read properties of documents and windows from the same server, protocol, and port
  - If the same server hosts unrelated sites, scripts from one site can access document properties on the other
- User can grant privileges to signed scripts
  - UniversalBrowserRead/Write, UniversalFileRead, UniversalSendMail

Risks of Poorly Written Scripts

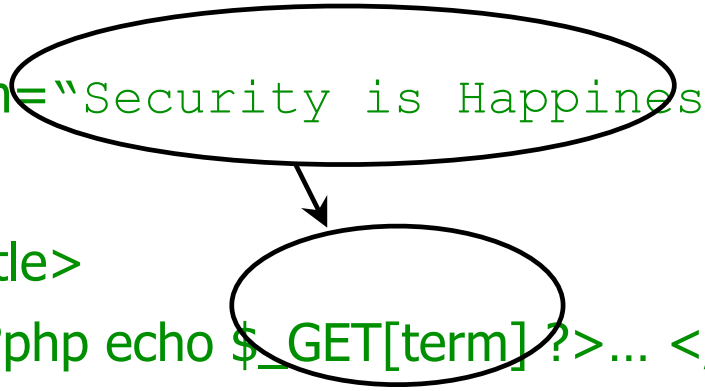
- For example, echo user's input

http://naive.com/search.php?term="Security is Happiness"

search.php responds with

<html> <title>Search results</title>

<body>You have searched for <?php echo $_GET[term] ?>… </body>



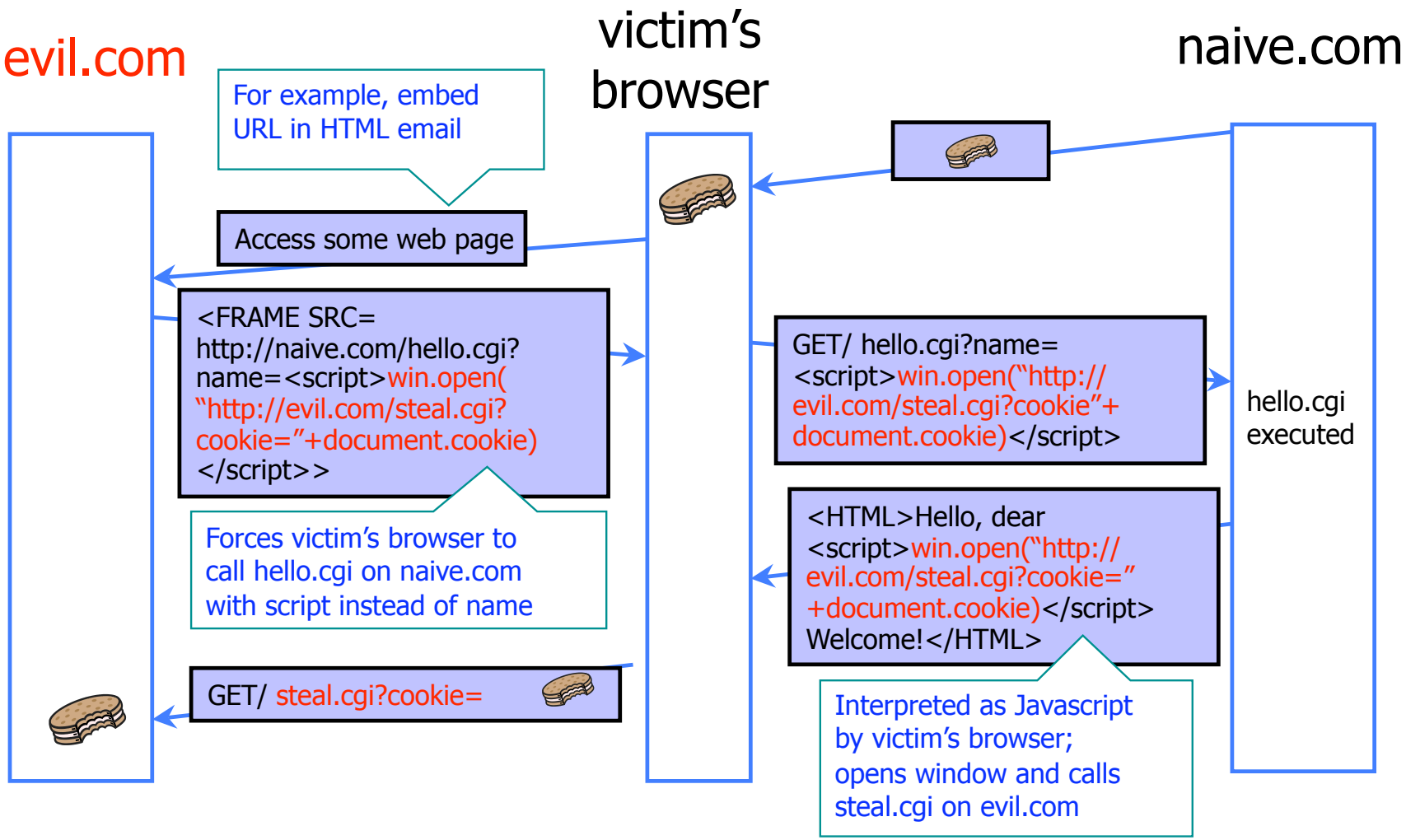
Or

GET/ hello.cgi?name=Bob

hello.cgi responds with

<html>Welcome, dear Bob</html>

Stealing Cookies by Cross Scripting



MySpace Worm (1)

http://namb.la/popular/tech.html

- Users can post HTML on their MySpace pages
- MySpace does not allow scripts in users' HTML
  - No <script>, <body>, onclick, <a href=javascript://>
- … but does allow tags for CSS.
  -
- But MySpace will strip out "javascript"
  - Use "java<NEWLINE>script" instead
- But MySpace will strip out quotes
  - Convert from decimal instead:

    alert('double quote: ' + String.fromCharCode(34))

MySpace Worm (2)

http://namb.la/popular/tech.html

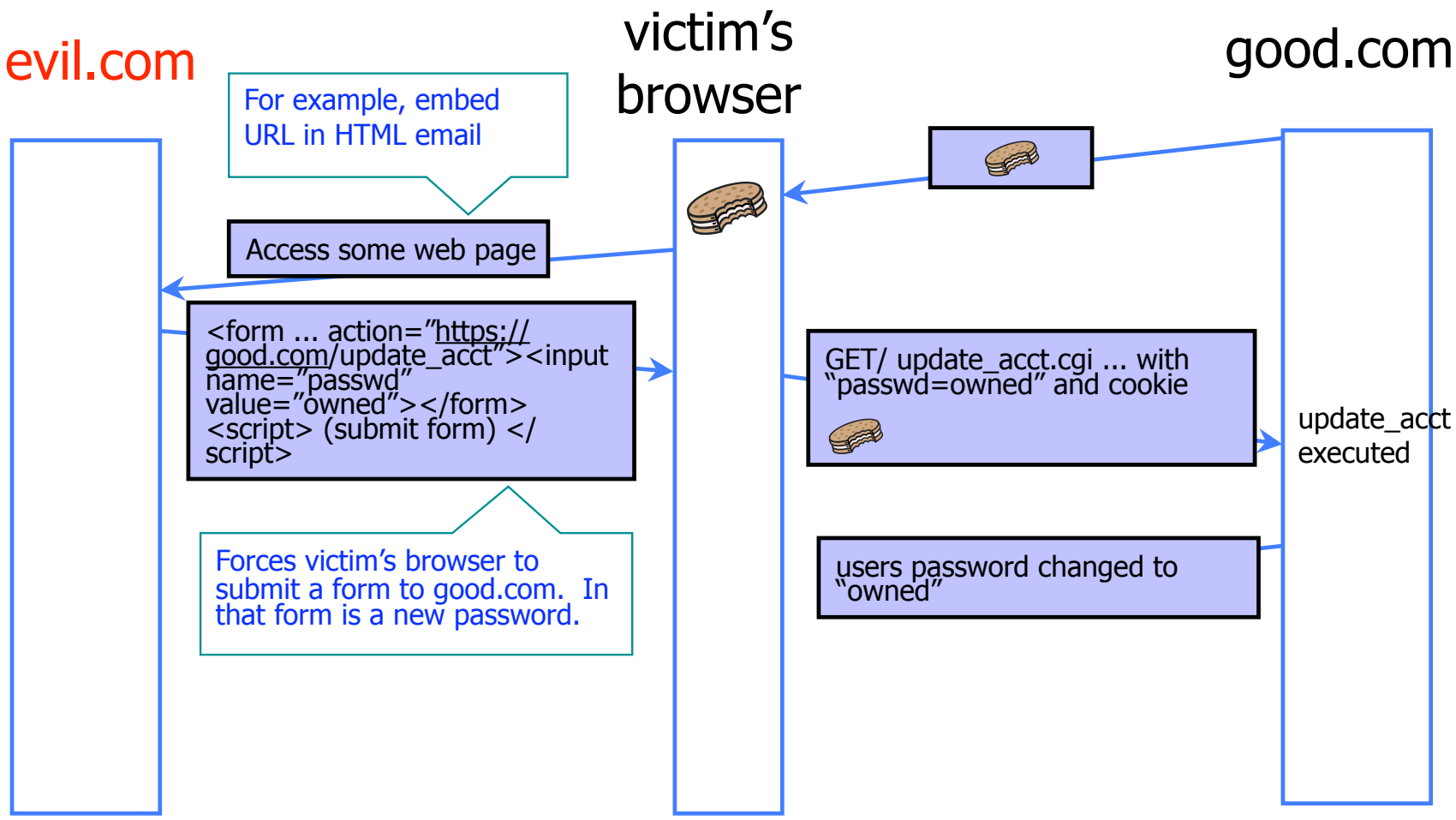
- "There were a few other complications and things to get around. This was not by any means a straight forward process, and none of this was meant to cause any damage or piss anyone off. This was in the interest of..interest. It was interesting and fun!"
- Started on "samy" MySpace page
- Everybody who visits an infected page, becomes infected and adds "samy" as a friend and hero
- 5 hours later "samy"

  has 1,005,831 friends
  - Was adding 1,000 friends per second at its peak
- Not an XSS attack

Cross Site Request Forgery

- Websites use cookies to authenticate you.
- Malicious website can initiate an action as you to a good website
  - Your cookie for the good website would be sent along with the request
  - Good website executes that action, thinking it was you

Changing Password with CSRF



History Stealing

- Pages in web browser are colored differently based on whether you have visited them or not
- Attacker can exploit this to figure out what web pages you have visited.

- Example:
  - http://ha.ckers.org/weird/CSS-history-hack.html
  - http://jeremiahgrossman.blogspot.com/2006/08/i-know-where-youve-been.html
  - Other examples are a bit more "directed"...