Overflows, Injection, and Memory Safety

CS 161: Computer Security
Prof. David Wagner
January 24, 2013
**Traveler Information**

**Traveler 1 - Adults (age 18 to 64)**

To comply with the [TSA Secure Flight program](https://www.tsa.gov), the traveler information listed here must exactly match the information on the government-issued photo ID that the traveler presents at the airport.

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<table>
<thead>
<tr>
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<th>First Name:</th>
<th>Middle Name:</th>
<th>Last Name:</th>
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<tr>
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<td></td>
<td></td>
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Travelers are required to enter a middle name/initial if one is listed on their government-issued photo ID.

Some younger travelers are not required to present an ID when traveling within the U.S. [Learn more](https://www.tsa.gov).

- **Known Traveler Number/Pass ID (optional):**
- **Redress Number (optional):**

**Seat Request:**
- [ ] No Preference
- [ ] Aisle
- [ ] Window
#293 HRE-THR 850 1930
ALICE SMITH
COACH

SPECIAL INSTRUX: NONE
# Traveler Information

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HHACH

SPECIAL INSTRUX: NONE
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**Title (optional):** Dr.  
**First Name:** Alice  
**Last Name:** Smith  
**Gender:** Female  
**Date of Birth:** 01/24/93

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- ☐ Window
#293 HRE-THR 850 1930
ALICE SMITH
FIRST

SPECIAL INSTRUX: NONE
#293 HRE-THR 850 1930
ALICE SMITH
FIRST

SPECIAL INTRUX: GIVE PAX EXTRA CHAMPAGNE.
char name[20];

void vulnerable() {
    ...
    gets(name);
    ...
}
char name[20];
char instrux[80] = "none";

void vulnerable() {
    ...
    gets(name);
    ...
}
char line[512];
char command[] = "/usr/bin/finger";

void main() {
    ...
    gets(line);
    ...
    execv(command, ...);
}
char name[20];
int seatinfirstclass = 0;

void vulnerable() {
    ...
    gets(name);
    ...
}
char name[20];
int authenticated = 0;

void vulnerable() {
    ...
    gets(name);
    ...
}
Code Injection
main()
{
  f();
}

f()
{
  int x;
  g();
}

g()
{
  char buf[80];
  gets(buf);
}
main()
{
  f();
}

f()
{
  int x;
  g();
}

g()
{
  char buf[80];
  gets(buf);
}
<table>
<thead>
<tr>
<th>Rank</th>
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<th>ID</th>
<th>Name</th>
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<tbody>
<tr>
<td>[1]</td>
<td>93.8</td>
<td>CWE-89</td>
<td>Improper Neutralization of Special Elements used in an SQL Command ('SQL Injection')</td>
</tr>
<tr>
<td>[2]</td>
<td>83.3</td>
<td>CWE-78</td>
<td>Improper Neutralization of Special Elements used in an OS Command ('OS Command Injection')</td>
</tr>
<tr>
<td>[3]</td>
<td>79.0</td>
<td>CWE-120</td>
<td>Buffer Copy without Checking Size of Input ('Classic Buffer Overflow')</td>
</tr>
<tr>
<td>[4]</td>
<td>77.7</td>
<td>CWE-79</td>
<td>Improper Neutralization of Input During Web Page Generation ('Cross-site Scripting')</td>
</tr>
<tr>
<td>[6]</td>
<td>76.8</td>
<td>CWE-862</td>
<td>Missing Authorization</td>
</tr>
<tr>
<td>[7]</td>
<td>75.0</td>
<td>CWE-798</td>
<td>Use of Hard-coded Credentials</td>
</tr>
<tr>
<td>[8]</td>
<td>75.0</td>
<td>CWE-311</td>
<td>Missing Encryption of Sensitive Data</td>
</tr>
<tr>
<td>[9]</td>
<td>74.0</td>
<td>CWE-434</td>
<td>Unrestricted Upload of File with Dangerous Type</td>
</tr>
<tr>
<td>[10]</td>
<td>73.8</td>
<td>CWE-807</td>
<td>Reliance on Untrusted Inputs in a Security Decision</td>
</tr>
<tr>
<td>[11]</td>
<td>73.1</td>
<td>CWE-250</td>
<td>Execution with Unnecessary Privileges</td>
</tr>
<tr>
<td>[12]</td>
<td>70.1</td>
<td>CWE-352</td>
<td>Cross-Site Request Forgery (CSRF)</td>
</tr>
<tr>
<td>[13]</td>
<td>69.3</td>
<td>CWE-22</td>
<td>Improper Limitation of a Pathname to a Restricted Directory ('Path Traversal')</td>
</tr>
<tr>
<td>[14]</td>
<td>68.5</td>
<td>CWE-494</td>
<td>Download of Code Without Integrity Check</td>
</tr>
<tr>
<td>[16]</td>
<td>66.0</td>
<td>CWE-829</td>
<td>Inclusion of Functionality from Untrusted Control Sphere</td>
</tr>
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</table>
void vulnerable() {
    char buf[64];
    ...
    gets(buf);
    ...
}
void still_vulnerable?() {
    char buf = malloc(64);
    ... 
    gets(buf);
    ...
    ...
    }

IE's Role in the Google-China War

By Richard Adhikari
TechNewsWorld
01/15/10 12:25 PM PT

The hack attack on Google that set off the company's ongoing standoff with China appears to have come through a zero-day flaw in Microsoft's Internet Explorer browser. Microsoft has released a security advisory, and researchers are hard at work studying the exploit. The attack appears to consist of several files, each a different piece of malware.

Computer security companies are scurrying to cope with the fallout from the Internet Explorer (IE) flaw that led to cyberattacks on Google (Nasdaq: GOOG) and its corporate and individual customers.

The zero-day attack that exploited IE is part of a lethal cocktail of malware that is keeping researchers very busy.

"We're discovering things on an up-to-the-minute basis, and we've seen about a dozen files dropped on infected PCs so far," Dmitri Alperovitch, vice president of research at McAfee Labs, told TechNewsWorld.

The attacks on Google, which appeared to originate in China, have sparked a feud between the Internet giant and the nation's government over censorship, and it could result in Google pulling away from its business dealings in the country.

Pointing to the Flaw

The vulnerability in IE is an invalid pointer reference, Microsoft (Nasdaq: MSFT) said in security advisory 979352, which it issued on Thursday. Under certain conditions, the invalid pointer can be accessed after an object is deleted, the advisory states. In specially crafted attacks, like the ones launched against Google and its customers, IE can allow remote execution of code when the flaw is exploited.
void safe() {
    char buf[64];
    ...
    fgets(buf, 64, stdin);
    ...
}
void safer() {
    char buf[64];
    ... 
    fgets(buf, sizeof buf, stdin);
    ...
}
void vulnerable() {
    char buf[64];
    if (fgets(buf, 64, stdin) == NULL) 
        return;
    printf(buf);
}
Fun With printf Format Strings ...

printf("100% dude!");
⇒ prints value 4 bytes above retaddr as integer

printf("100% sir!");
⇒ prints bytes pointed to by that stack entry up through first NUL

printf("%d %d %d %d ...");
⇒ prints series of stack entries as integers

printf("%d %s");
⇒ prints value 4 bytes above retaddr plus bytes pointed to by preceding stack entry

printf("100 % nuke’m!");
⇒ writes the value 3 to address pointed to by stack entry