# Ex070 Report

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## Goal

The goal in this exercise was to exploit a buffer-vulnerable program owned by Brian Oppenheimer using fuzzing and logical inference.

# Technical Report

## Introduction

## Finding: *Lack of authentication on an administrative system program*

#### Severity Rating: 4.3

This vulnerability may allow unwanted personnel to perform detailed information-gathering on the local machine related to its running processes and network services.

**CVSS Base Severity Rating: 4.3** AV:A AC:L PR:N UI:N S:U C:L I:N A:N

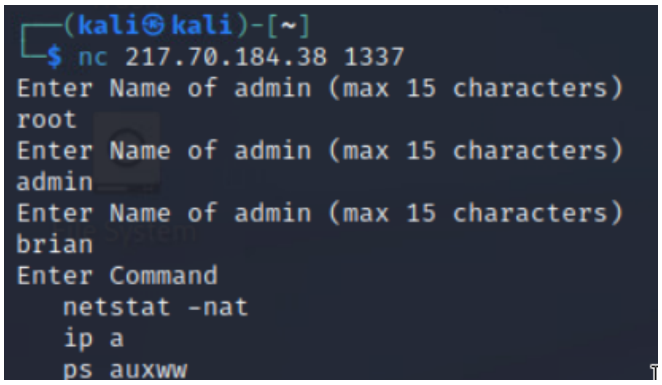
#### Vulnerability Description

On the 217.70.184.38 machine, the running service on port 1337 is intended to give system administrators information about the host without having to log in. It provides the ability to execute `netstat -nat`, `ip a`, and `ps auxww` to view network information, view local network interfaces, and monitor running processes on the system, respectively.

Due to the lack of authentication however, all a non-authorized user needs to view the same information is to know the name of an administrator, allowing them to view the above information regardless of their lack of authorization to do so.

#### Confirmation method

With the publicly available information that Brian posted, all a malicious actor needs to do is `nc 217.70.184.38 1337` and input the name `brian` to gain the aforementioned abilities:




**Mitigation or Resolution Strategy**

Ideally, remove the service altogether. Although it may save some time for system administrators, their job should be done through established, formal methods that handle authentication already.

An authentication system could be implemented, such as a password system, but doing so properly would involve more time than is typically worth for a simplistic service like this.

## Finding: *Buffer overflow vulnerability on administrative program allows compromise of user account*

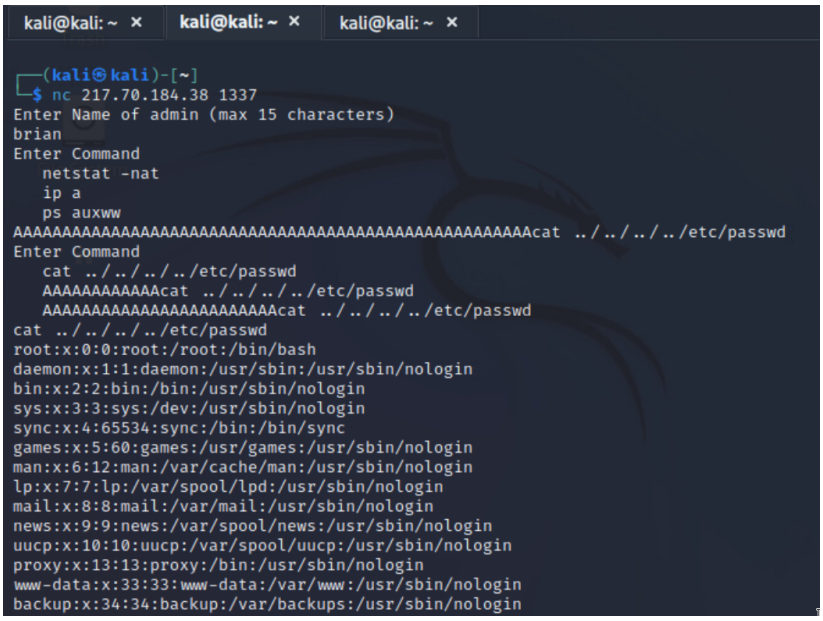
**Severity Rating: 7.0**

This vulnerability effectively lets a malicious actor run any command that the user `brian` has on the remote system.

This attack does not, however, grant root permissions to upon exploitation.
**CVSS Base Severity Rating: 7.0** AV:A AC:L PR:N UI:N S:C C:H I:L A:N

**Vulnerability Description**

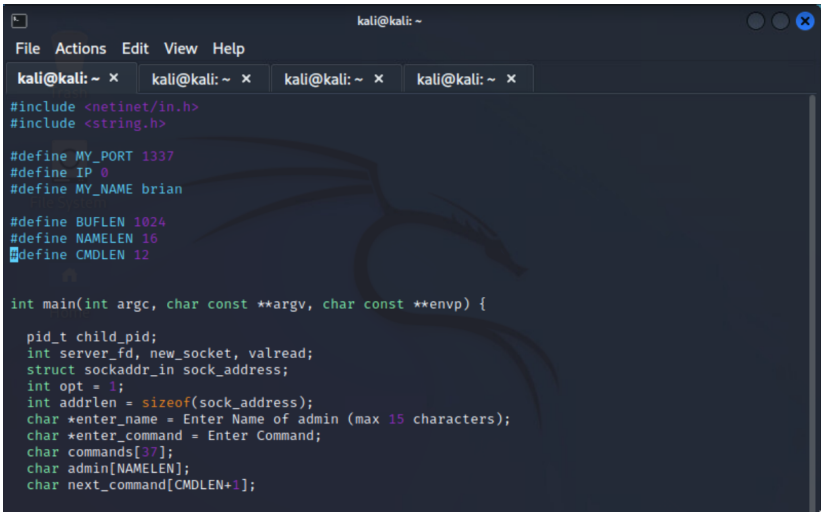
By logging in as `brian` on the service running on port 1337, and then inputting 53 'A's followed by the desired command, this vulnerability lets a malicious actor run any command on the system that the user `brian` is allowed to run, as shown in the following screenshot:




This is possible because the buffer that stores the command that the user input overflows, overwriting the list of acceptable commands from the program with whatever comes after the 53 'A' characters.

### Confirmation method

Note the above screenshot showcasing access to the `/etc/passwd` file (`/etc/shadow` was not accessible as the compromised user), along with the following source code (obtained via overflowing the buffer and running `cat /home/brian/toool.c`):



Take note of the fact that BUFLEN is defined as 1024, while NAMELEN and CMDLEN are defined as 16 and 12, respectively. This means that (by looking at the code below the C definitions), that the admin array (buffer) is of length 16, and the next_command array is of length $12 + 1 = 13$. Now, take a look at the two calls to `fgets()` in the following screenshot


Brian made one right choice in using a function like `fgets`, which lets the source code writer specify the size of the input to be read into the buffer, as opposed to a function like `gets` which does not.

The reason this code is still vulnerable, however, is because the code specifies an input length that exceeds the size of the buffer it is reading it into. To be specific, a maximum of 1024 tcharacters can be read into the `next_command` array (this is the buffer we overflowed in the screenshots) and the `admin` array. However, as we just saw, both of those are significantly smaller than 1024 characters in length. Thus, the possibility is opened that we can overflow these buffers, which we do, and it ends up spilling over into the `commands` array, altering the commands we can execute on the system

**Mitigation or Resolution Strategy**

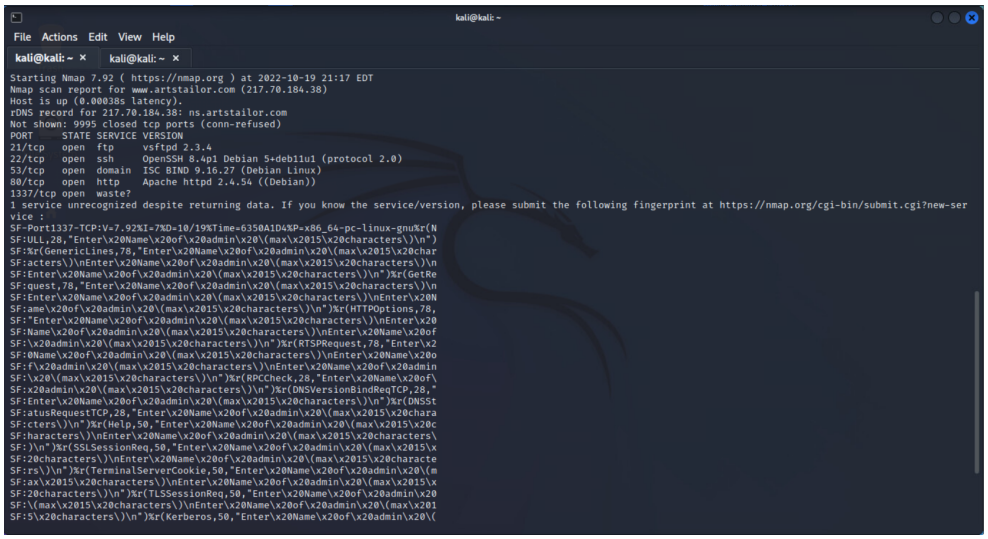
As mentioned in the previous vulnerability, the best case scenario is to remove the program entirely as its purpose is better and more securely accomplished through established methods such as ssh'ing into the machine.

Alternatively, the source code can be edited to perform a check that the inputs for both the administrator username and the command name are equal to or smaller than the length of their respective buffers.

# Attack Narrative

### Nmap scan

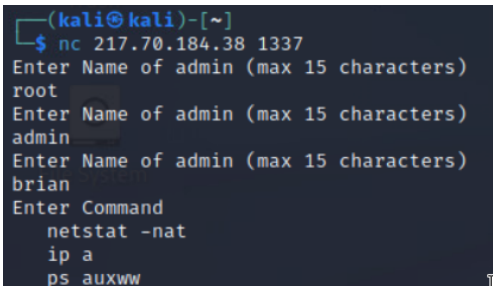
It appeared to be that a complete 65k+ port scan of nmap took an unusually long amount of time, so for this exercise, we settled for performing a port scan only on the first 10,000 ports of `www.artstailor.com`:




Fortunately, this turned out to be enough to find a mysterious service listening on port 1337 on the remote machine. We can infer that this is the correct service because:

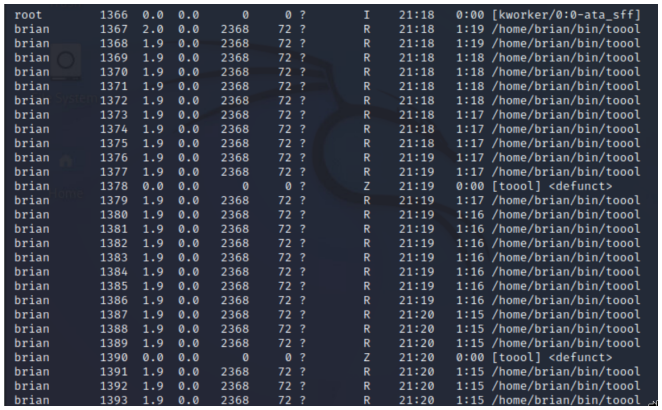
1. The listening port is '1337', a number alluded to in Brian's message.
2. We see that the probes that nmap sent over to this port triggered responses containing strings that comprise "Enter name of admin," which correspond to the functionality Brian described in the message.

Using a relatively simple `nc` command, we were able to trigger the aforementioned response from the service asking us to enter the name of an admin. The names "admin" and "root" were unsuccessfully attempted, until arriving to an accepted name which was simply "brian":



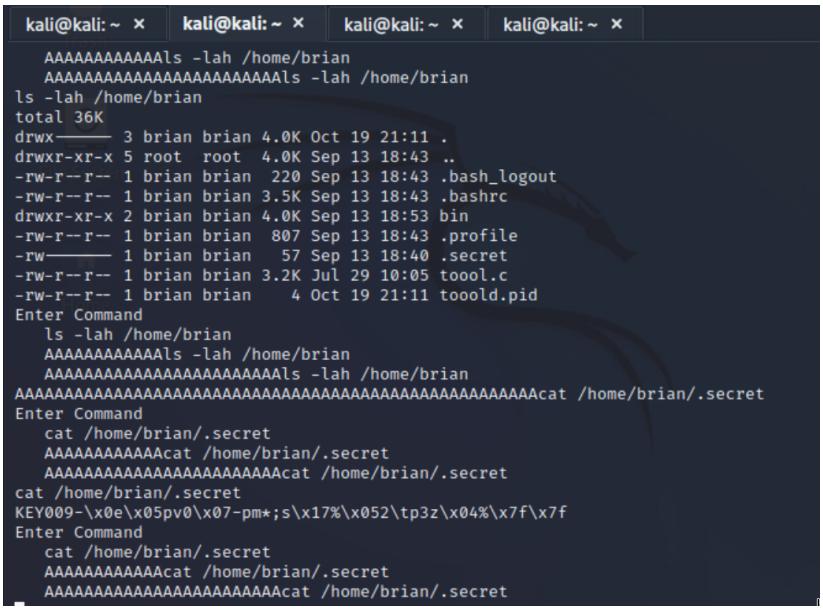

Before even getting to the buffer overflow vulnerability of this program, the fact that someone can gain the information given by the available commands is in itself a vulnerability in respect to system confidentiality, because a malicious user simply has to know the name of an administrator with no element of authentication at the login.

Upon gaining access to the service with the aforementioned username, we can use one of the available commands (`ps auxww`) to see that the service running on port 1337 is a process by the name of `toool` in the directory `/home/brian/bin`.




Also, it seems that the commands we can input change if we type a sufficiently long string to the program (see the **Technical Report** section). With this knowledge, we can 1) list the contents in the `/home/brian` directory to find the source code for the running process (`toool.c`) and 2) output the contents of the source code to discover the bug in the code that makes it vulnerable to buffer overflows. For details, refer to the **Technical Report** section.

To expand upon the previously mentioned step of "listing the contents" of the `/home/brian` directory, it turns out that if we use the `-a` option in the `ls` command, we come across a file called `.secret` that is normally not seen without said option, which contains KEY009 inside:




KEY009-\x0e\x05pv0\x07-pm*;s\x17%\x052\tp3z\x04%\x7f\x7f

## MITRE ATT&CK Framework TTPs

**TA0007:** Discovery
- **T1046:** Network Service Discovery
  - **NA:** NA

**TA0001:** Initial Access
- **T1190:** Exploit Public-Facing Application
  - **NA:** NA