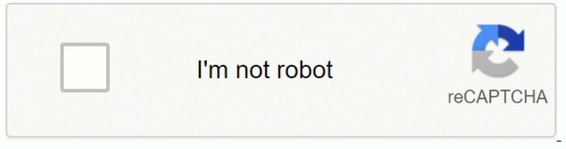


Open

Buffer overflow vulnerability lab report

```cpp
#include <iostream>
using namespace std;
  int main(void)
  {
      int tests[10];
      int test;
      int num_elems;

      cout << "How many numbers? ";
      cin >> num_elems;

      for (int i = 0; i < num_elems; i++)
          {
              cout << "Please type a number: ";
              cin >> test;
              tests[i]= test;
          }
      return 0;
  }
```

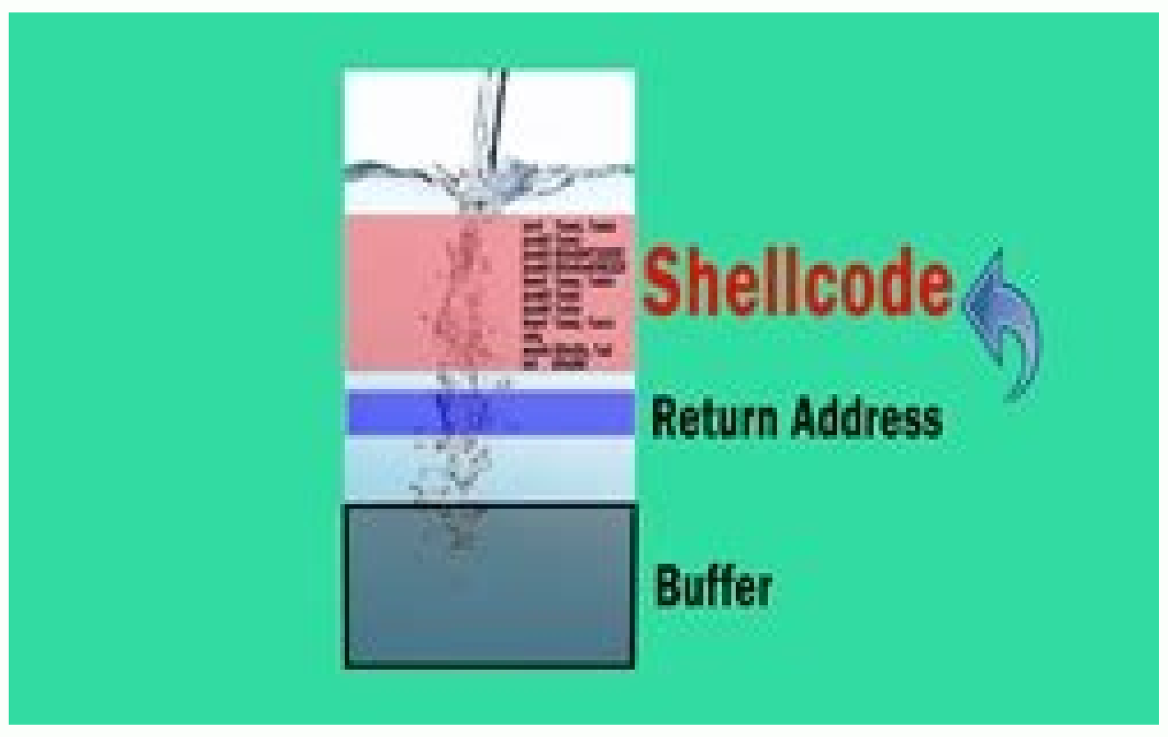
SEED Labs – Buffer Overflow Vulnerability Lab 5

Set-UID bit, because ownership change will cause the Set-UID bit to be turned off.

```
$ gcc -o stack -z execstack -fno-stack-protector stack.c
$ sudo chown root stack          ①
$ sudo chmod 4755 stack          ②
```

The above program has a buffer overflow vulnerability. It first reads an input from a file called badfile, and then passes this input to another buffer in the function bof(). The original input can have a maximum length of 517 bytes, but the buffer in bof() is only 24 bytes long. Because strcpy() does not check boundaries, buffer overflow will occur. Since this program is a Set-root-UID program, if a normal user can exploit this buffer overflow vulnerability, the normal user might be able to get a root shell. It should be noted that the program gets its input from a file called badfile. This file is under users' control. Now, our objective is to create the contents for badfile, such that when the vulnerable program copies the contents into its buffer, a root shell can be spawned.

For Instructor: To test whether students really know how to conduct the attack, during the demo time, ask students to change the buffer size from 24 to another number in the vulnerable program stack.c. If students really know the attack, they should be able to modify their attacking code and successfully launch the attack.



Buffer Overflow Vulnerability Lab
1 Lab Overview
The learning objective of this lab is for students to gain the first-hand experience on buffer-overflow vulnerability
by putting what they have learned about the vulnerability from class into actions. Buffer overflow is
defined as the condition in which a program attempts to write data beyond the boundaries of pre-allocated
fixed length buffers. This vulnerability can be utilized by a malicious user to alter the flow control of the
program, even execute arbitrary pieces of code. This vulnerability arises due to the mixing of the storage
for data (e.g. buffers) and the storage for controls (e.g. return addresses): an overflow in the data part can
affect the control flow of the program, because an overflow can change the return address.
In this lab, students will be given a program with a buffer-overflow vulnerability; their task is to develop
a scheme to exploit the vulnerability and finally to gain the root privilege. In addition to the attacks, students
will be guided to walk through several protection schemes that have been implemented in Fedora to counter
against the buffer-overflow attacks. Students need to evaluate whether the schemes work or not and explain
why.
2 Lab Tasks
2.1 Initial setup
You can execute the lab tasks using the preconfigured Ubuntu machine. Ubuntu and several other Linuxbased
systems uses address space randomization to randomize the starting address of heap and stack. This
makes guessing the exact addresses difficult; guessing addresses is one of the critical steps of buffer-overflow
attacks. In this lab, we disable these features using the following commands:
$ su root
Password: (enter root password)
#sysctl -w kernel.randomize_va_space=0
ExecShield Protection: Fedora linux implements a protection mechanism called ExecShield by default,
but Ubuntu systems do not have this protection by default. ExecShield essentially disallows executing any
code that is stored in the stack. As a result, buffer-overflow attacks will not work. To disable ExecShield in
Fedora, you may use the following command.
$ su root
Password: (enter root password)
sysctl -w kernel.exec-shield=0
Laboratory for Computer Security Education 2
If you are using a Fedora virtual machine for executing this lab task, please disable exec-shield before doing

Portanto, vamos ligar/bin/sh a outra shell que nÃ£o tenha tal contramedida (em tarefas posteriores, vamos mostrar que com um pouco mais de esforÃ§o, a contramedida in/bin/dash pode ser facilmente derrotada). Esta marcaÃ§Ã£o Ã© feita automaticamente pelas versÃµes recentes do gcc, e por padrÃ£o, as pilhas sÃ£o definidas para nÃ£o serem executÃ¡veis. After finding the address of ebp we need to find the starting address of buffer[24] which is buffer[0] so that we can calculate offsetp $ebpp &bufferp $ebp Ã¢ÂÂ p &bufferfig2: address of buffer and ebpWe found that the outputs to be$ebp = 0xbfffeb08&buffer = 0xbffeae8$ebp- &buffer = 0x20 = 32(in decimal)As we know that the return address is at ebp + 4 byte as the size of frame pointer is 4 bytes so the return address is at 32+4=36 bytes from the buffer.After determining the return address we replace the return address by something by ebp + offset where offset can be any value that will map it to the address containing NOP instructions that will eventually lead to the address containing shell code.fig 3: adding code to exploit.cWe can also add the memory location using little Endian format which is*(buffer+36) = 0x90;*(buffer+37) = 0xeb;*(buffer+38) = 0xff;*(buffer+39) = 0xbf;Note: 0xbfffeb08+0x88 = 0xbfffeb90Here we have added 0x88 (128) into the ebp address . Aqui a funÃ§Ã£o bof tem um programa de buffer overflow EntÃ£o quando a funÃ§Ã£o principal chama bof podemos executar o buffer overflow na pilha da funÃ§Ã£o bof substituindo o endereÃ§o de retorno na pilha. Em bof temos buffer[24] entÃ£o se empurrarmos mais dados. Aqui estÃ¡ o programa bÃ¡sico de exploraÃ§Ã£o fornecido para nÃ³s. 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