Challenge Write Up

Week Zero

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NYU | TANDON

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Challenge Details

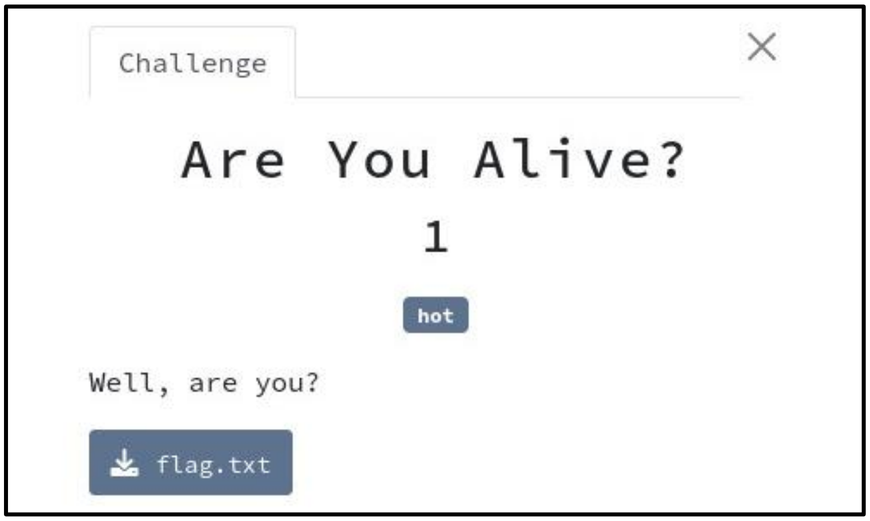
Are You Alive

Overview

Are You Alive		
1 Point	Flag Value	flag{youve_been_lied_to_about_how_your_computer_works}
	Exploit Type	N/A

Details

The challenge begins with a prompt asking the user to download a text file titled flag.txt, as shown in the following figure:



Challenge

Are You Alive?

1

hot

Well, are you?

flag.txt

Download Prompt

The text file contains the challenge flag, as shown below:

```
┌──(kali㉿kali)-[~/Downloads]
└─$ ls -latr
total 12
-rw-r--r--  1 kali kali   54 Jan 31 14:09 flag.txt
...omitted for brevity...
┌──(kali㉿kali)-[~/Downloads]
└─$ cat flag.txt
flag{youve_been_lied_to_about_how_your_computer_works}
```

File Contents

Steps to Reproduce

1. Download file
2. View file contents

   Ex:

   `cat flag.txt`

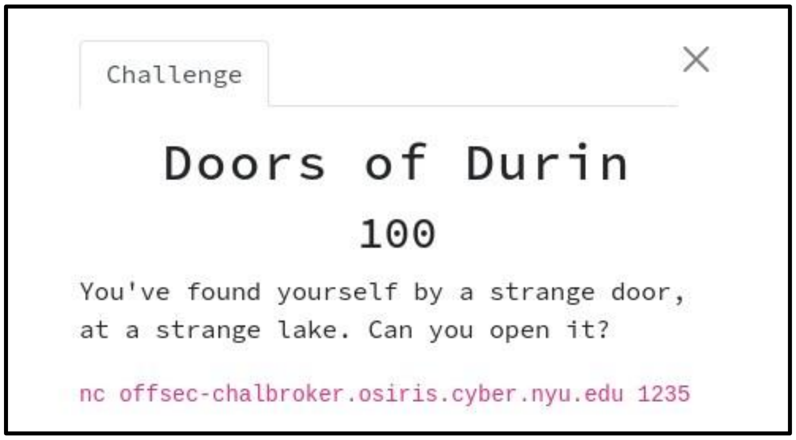
Doors of Durin

Overview

Doors of Durin		
100 Points	Flag Value	flag{the_dwarves_dug_too_deep}
	Exploit Type	Nerd

Details

The challenge begins with a prompt directing students to connect to `offsec-chalbroker.osiris.cyber.nyu.edu` at port 1235.



Challenge

Doors of Durin

100

You've found yourself by a strange door, at a strange lake. Can you open it?

`nc offsec-chalbroker.osiris.cyber.nyu.edu 1235`

Challenge Prompt

Connecting to the service reveals a text-based adventure game playing through a Lord of the Rings scene. The game prompts the user to answer the riddle, "Speak friend and enter." The game text is shown in the following figure:

```
~$ nc offsec-chalbroker.osiris.cyber.nyu.edu 1235
You and your party of a Wizard, a Dwarf, and Elf, 2 Men, and 3 other Hobbits stand
around the Doors of Durin, the entrance to the Dwarven Mines of Moria.
A door blocks your way into the Mines, the only remaining path you have to get to
the forest Lothlórien, where the Lady Galadriel is sure to offer you sanctuary from
the dark forces pursuing you.

The Wizard looks at the Doors, and reads:
        "Ennyn Durin Aran Moria. Pedo mellon a Minno. Im Narvi hain echant.
Celebrimbor o Eregion tethant. I thiw hin."

You ask, "What does it mean?"

"Oh, it is a simple riddle," says the Wizard.
        "The Doors of Durin, Lord of Moria. Speak friend and enter. I Narvi made
them. Celebrimbor of Hollin drew these signs."

You think for a moment. "Speak friend and enter." What could it mean?
Suddenly, the answer comes to you!
You shout:
```

Game Text

The Tolkien elvish word for friend is "Mellon," and after a few spelling errors, the user successfully input the password and gained access to the challenge flag, as shown below:

```
Suddenly, the answer comes to you!
You shout: mellon
The Doors open! As you delve into the Mines, you hear a whisper on the wind:
        The flag is: flag{the_dwarves_dug_too_deep}
```

Password Correct

An attacker would not need to use an exploit to attack this system. Any attacker with working knowledge of Lord of the Rings would be able to guess the password and obtain the challenge flag.

Steps to Reproduce

1. Spend your childhood in Alaska with no TV and only books for company.
2. Connect to the system with the following command:
   `nc offsec-chalbroker.osiris.cyber.nyu.edu 1235`
3. Input the password

Mathwhiz

Overview

Mathwhiz		
200 Points	Flag Value	flag{you_sure_are_a_math_genius}
	Exploit Type	Programming

Details

This challenge begins with a prompt similar to the one provided with the Doors of Durin challenge. The URL is the same as the Doors of Durin challenge, but the port number is different. After connecting to the service running on port 1236, the student faces a math challenge. To complete the challenge, the user must successfully answer 100 math questions in a row. The questions increase in difficulty by switching between decimal numbers, text values, and numbers encoded in hexadecimal and binary. The connection closes if the user inputs the wrong answer or an answer that is not a number.

To solve this challenge, the user's code must account for all the different formats in which the math problems are presented. The following method is a part of a program that successfully defeated the challenge.

```
def main():
	# Start remote connection
	URL = "offsec-chalbroker.osiris.cyber.nyu.edu"
	PORT = 1236
	conn = start(URL, PORT)

	log = open("MathWhiz.txt", "a")

	# Get the greeting, which is 183 char/183 bytes long
	g = conn.recvn(183)
	log.write("Greeting: " + str(g) + "\n")

	# Get the math problem next
	n = QandA(conn, log)

	log.close()
```

Main Method

After connecting to the remote service and receiving a greeting, the program enters the QandA method, shown below, which takes in new math problems, passes them to the solver method, and then responds with the correct answer.

```
def QandA(conn, log):
	n = 0
	while n < 100:
		log.write("Question " + str(n) + "\n")
		b = conn.recvline()
		ans = doSomeMath(b, log)
		#conn.pack(ans)
		conn.sendline(ans)
		b = conn.recvline()
		log.write(str(b) + "\n")
```

```
            n+=1
        b = conn.recvall()
        print((str(b) + "\n"))
        log.write(str(b) + "\n")
```

Q and A Method

The solver method, depicted in the following figure, translates a math problem into a format that the Python `eval` function can accept. The solver checks each number to see if it is written in text, in which case it calls a translator method to translate the written number into an integer. Because the `eval` function accepts encoded input, the only condition that the method must check for is text.

```
def doSomeMath(byteString, log):
        # Translate into readable problem
        byteString = byteString[:-4]
        problem = str(byteString, encoding='utf-8')
        log.write(problem)
        mathList = problem.split()
        i = 0
        while i < len(mathList):
                # Check to see if the number is made of text or not
                if re.search("^\D+$", mathList[i]):
                        mathList[i] = textToIntStr(mathList[i])
                i += 2
        mathString = " ".join(mathList)
        # Perform calculation and return answer
        str_ans = str(eval(mathString))
        byte_ans = str_ans.encode()
        log.write(" = " + str_ans+ "\n")
        return byte_ans
```

Solver Method

After checking and translating each number, the solver calculates the answer using the eval function.

The text numbers are formatted as `[Digit]-[Digit]-[Digit]`. The translator method takes the text number and iterates through each digit to translate it to the decimal format before returning a numerical string. The method is shown below:

```
def textToIntStr(t):
        tStr = t.split("-")
        a = tStr
        n = 0
        for num in tStr:
                a[n] = str(getValue(num))
                n+=1

        ans = "".join(a)
        return ans
```

Solver Method

The complete code is available in Appendix C.

Appendix A: Student Information

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Appendix B: Tools

Name	URL
PwnTools	https://github.com/Gallopsled/pwntools
Net Cat	https://netcat.sourceforge.net/

Appendix C: Mathwhiz Code Solution

```
from pwn import *
import re

# A function to start the remote connection
#       Input: URL string, Port int
#       Output: Connection
def start(U, P):
        io = remote(U, P)
        return io

# Gets the integer value of a text number
#       Input: Text string number
#       Output: Integer
def getValue(t):
        if t == "ONE":
                return 1
        elif t == "TWO":
                return 2
        elif t == "THREE":
                return 3
        elif t == "FOUR":
                return 4
        elif t == "FIVE":
                return 5
        elif t == "SIX":
                return 6
        elif t == "SEVEN":
                return 7
        elif t == "EIGHT":
                return 8
        elif t == "NINE":
                return 9
        elif t == "ZERO":
                return 0

# A function to translate a text string into a string of integers
#       Input: Text string number
#      Output: Itegers in string form
def textToIntStr(t):
       tStr = t.split("-")
       a = tStr
       n = 0
       for num in tStr:
              a[n] = str(getValue(num))
              n+=1

       ans = "".join(a)
       return ans


# A function to translate the response into a math problem and return the answer
#      Input: Byte string representing math problem and the log file
#      Output: Byte string representing the answer
def doSomeMath(byteString, log):
       # Translate into readable problem
       byteString = byteString[:-4]
       problem = str(byteString, encoding='utf-8')
       log.write(problem)
       mathList = problem.split()
       i = 0
       while i < len(mathList):
              # Check to see if the number is made of text or not
              if re.search("^\D+$", mathList[i]):
                     mathList[i] = textToIntStr(mathList[i])
              i += 2
       mathString = " ".join(mathList)
       # Perform calculation and return answer
       str_ans = str(eval(mathString))
       byte_ans = str_ans.encode()
       log.write(" = " + str_ans+ "\n")
       return byte_ans

# A function to recieve questions and send answers
#      Input: Connection
#      Output: Number of problems completed
def QandA(conn, log):
       n = 0
       while n < 100:
              log.write("Question " + str(n) + "\n")
              b = conn.recvline()
              ans = doSomeMath(b, log)
              #conn.pack(ans)
              conn.sendline(ans)
              b = conn.recvline()
              log.write(str(b) + "\n")
              n+=1
       b = conn.recvall()
       print((str(b) + "\n"))
```

```
	log.write(str(b) + "\n")

def main():
	# Start remote connection
	URL = "offsec-chalbroker.osiris.cyber.nyu.edu"
	PORT = 1236
	conn = start(URL, PORT)

	log = open("MathWhiz.txt", "a")

	# Get the greeting, which is 183 char/183 bytes long
	g = conn.recvn(183)
	log.write("Greeting: " + str(g) + "\n")

	# Get the math problem next
	n = QandA(conn, log)

	log.close()



if __name__=="__main__":
	main()
```