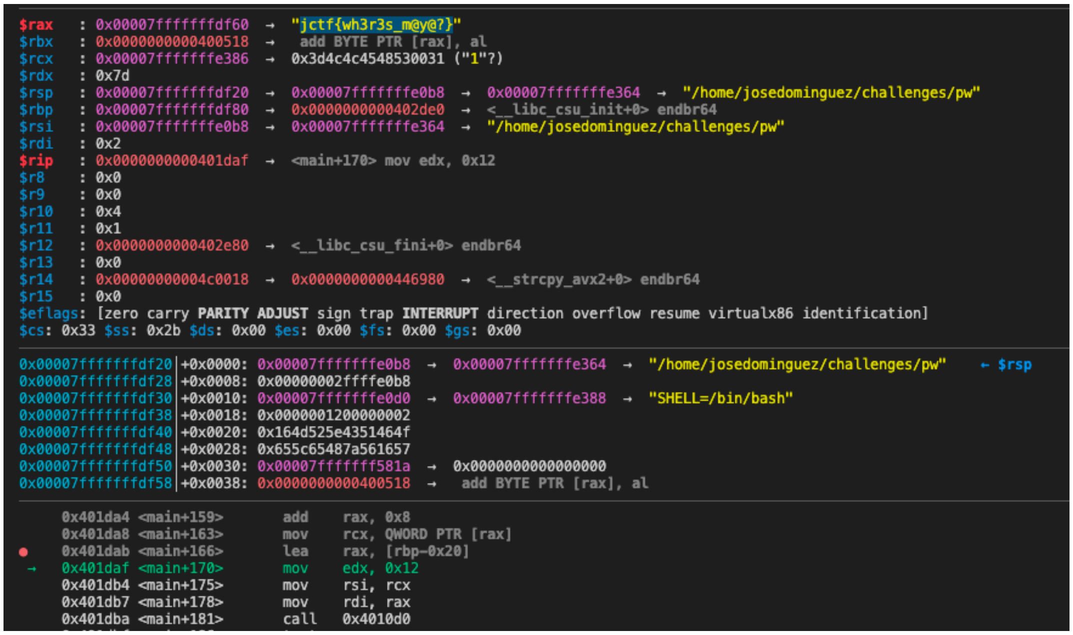
PasswordManager

This challenge performs some calculations that generate the flag.

To obtain the flag, a breakpoint can be set in an instruction that uses the flag once it has been calculated. For instance, we can set a breakpoint in the LEA instruction on main+166.

The flag can be observed in the rax register, as shown in the following screenshot:



The flag for this challenge is **jctf{wh3r3s_m@y@?}**

searching-through-vines

This program emulates a limited shell. It only accepts commands containing five letters or fewer, excluding ls, cat, cd, pwd, or less.

One solution is executing the bash command, which comprises 4 letters and spawns a new shell where commands can be executed without constraints. Hence, the content of the flag.txt file can be read.

Another solution is to execute the vi command, which only comprises 2 letters, and executing shell commands from the vi console.

The flag for this challenge is **jctf{nav1gat10n_1s_k3y}**

MathTest

This program does the following:

1. Asks for a name
2. Asks for a number x such that:
    a. 0x9000*x < 0
    b. x >= 0
3. Asks for a number y such that:
    a. 0xdeadbeef * y != 0
    b. y < 0
4. Asks for a char z such that:
    a. 'O' * z = 'A'
5. Verifies x + y + z == name

A possible value for y is very easy to guess. For instance, -1 satisfies both conditions. However, the rest of the inputs are difficult to guess and the Z3 solver was used to calculate each of these inputs. In addition, a Python script was created since the name is treated as binary data with no encoding, which is difficult to handle using the terminal.

The flag for this challenge is **jctf{C4CLULAT0R_US3R}**

RunningOnPrayers

The binary has the following security features:

```
josedominguez@offsec:~/challenges$ pwn checksec RunningOnPrayers
[*] '/home/josedominguez/challenges/RunningOnPrayers'
    Arch:     amd64-64-little
    RELRO:    Partial RELRO
    Stack:    No canary found
    NX:       NX unknown - GNU_STACK missing
    PIE:      No PIE (0x400000)
    Stack:    Executable
    RWX:      Has RWX segments
```

It is worth noting that that stack is executable, so if we find a way to inject code into the stack and hijack the execution to the inserted code, we can obtain a shell by executing the *execve* syscall with an address to “bin/sh”.

After inspecting the binary, we can see that the program has a **buffer overflow** vulnerability due to the use of the gets function. Additionally, the bytes “\xFF\xE4” are present in the program. These bytes correspond to the **jmp rsp** instruction, which can be used to execute code in the stack. Consequently, we can use the buffer overflow vulnerability to replace the return address with the address to the jmp rsp gadget (PIE is disabled) and insert the shell payload immediately after this instruction. See the Python script for this exploit.

The flag for this challenge is **jctf{Really_Obvious_Problem}**

StageLeft

This challenge is very similar to the previous one, except that instead of using a gets function, the fgets function is used with a size of 0x40, which does not allow to inject the entire payload after the return address in the stack. To solve this problem, the payload is inserted into the beginning of the buffer and the following instructions are inserted after the jmp rsp instruction:

- sub rsp, 48
    - Moves the stack pointer to the beginning of the buffer
- jmp rsp
    - Executes the payload contained in the buffer

The security features for the binary are the same as those of the previous one:

```
josedominguez@offsec:~/challenges$ pwn checksec StageLeft
[*] '/home/josedominguez/challenges/StageLeft'
    Arch:     amd64-64-little
    RELRO:    Partial RELRO
    Stack:    No canary found
    NX:       NX unknown - GNU_STACK missing
    PIE:      No PIE (0x400000)
    Stack:    Executable
    RWX:      Has RWX segments
```

See the Python script for this exploit.

The flag for this challenge is **jctf{Center_Of_Attention}**