

NAME : ADITYA RAJ PANDIT

REG NO : 23BRS1157

BOOT LOADER PROGRAM

Installing nasm

```
ex5@208-14ThinkStation-P348: ~  
File Edit View Search Terminal Help  
ex5@208-14ThinkStation-P348:~$ sudo apt install nasm  
[sudo] password for ex5:  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
nasm is already the newest version (2.14.02-1).  
The following package was automatically installed and is no longer required:  
  libssl-dev  
Use 'sudo apt autoremove' to remove it.  
0 upgraded, 0 newly installed, 0 to remove and 569 not upgraded.  
ex5@208-14ThinkStation-P348:~$
```

Creating first bootloader program (it does nothing)

```
ex5@208-14ThinkStation-P348: ~/Documents/23brs1157  
File Edit View Search Terminal Help  
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ touch firstBootLoader.asm  
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$
```

Edit the file in any text editor

```
firstBootLoader.asm (~/.Documents/23brs1157)  
File Edit View Search Tools Documents Help  
firstBootLoader.asm x  
[BITS 16]  
[ORG 0x7C00] ;  
;  
  
JMP $ ;  
  
TIMES 510 - ($ - $$) db 0 ;  
DW 0xAA55 ;|
```

Compile the first bootloader program

```
ex5@208-14ThinkStation-P348: ~/Documents/23brs1157
File Edit View Search Terminal Help
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ touch firstBootLoader.asm
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ nasm firstBootLoader.asm -f bin -o boot.bin
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$
```

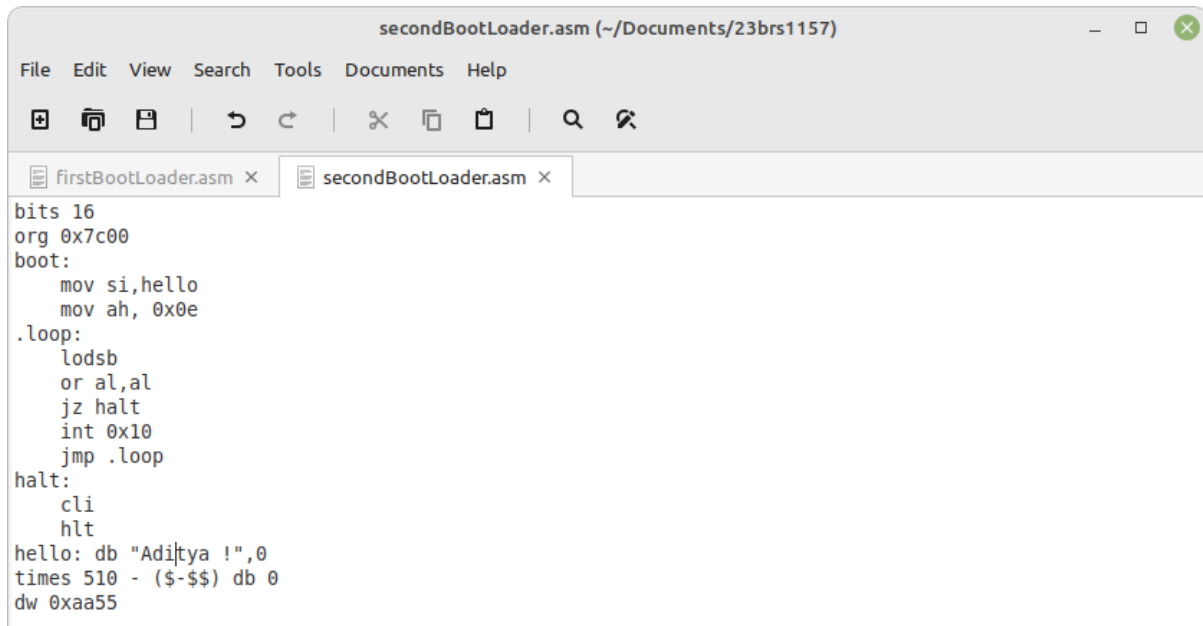
Create a floppy image

```
ex5@208-14ThinkStation-P348: ~/Documents/23brs1157
File Edit View Search Terminal Help
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ touch firstBootLoader.asm
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ nasm firstBootLoader.asm -f bin -o boot.bin
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ dd if=boot.bin bs=512 of=floppy1.img
1+0 records in
1+0 records out
512 bytes copied, 0.000275997 s, 1.9 MB/s
```

Create a second bootloader program (prints the character 'A!')

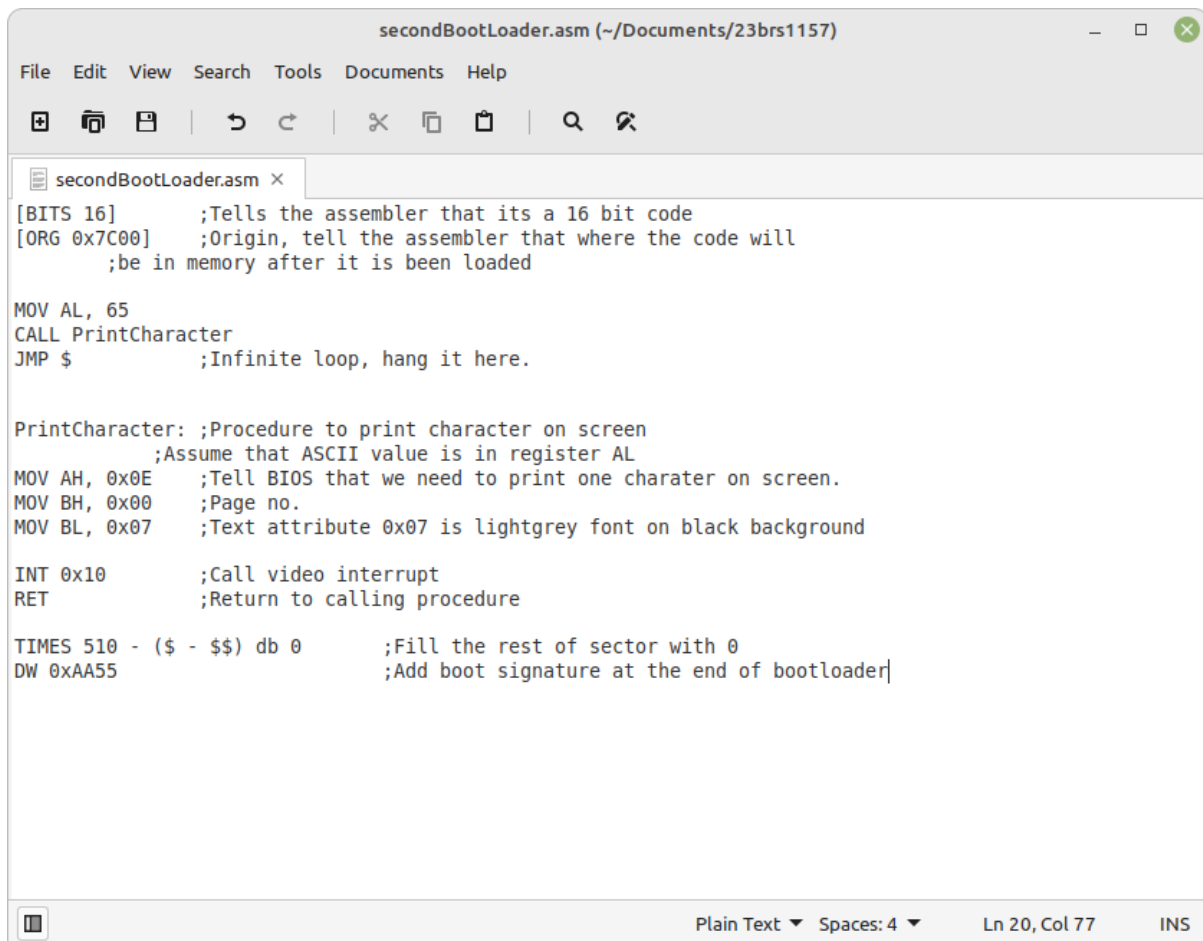
```
ex5@208-14ThinkStation-P348: ~/Documents/23brs1157
File Edit View Search Terminal Help
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ touch firstBootLoader.asm
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ nasm firstBootLoader.asm -f bin -o boot.bin
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ dd if=boot.bin bs=512 of=floppy1.img
1+0 records in
1+0 records out
512 bytes copied, 0.000275997 s, 1.9 MB/s
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ touch secondBootLoader.asm
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$
```

Edit the file in any text editor



The screenshot shows a text editor window titled "secondBootLoader.asm (~/.Documents/23brs1157)". The menu bar includes File, Edit, View, Search, Tools, Documents, and Help. The toolbar contains icons for file operations and search. The editor has two tabs: "firstBootLoader.asm" and "secondBootLoader.asm". The code in the active tab is as follows:

```
bits 16
org 0x7c00
boot:
    mov si,hello
    mov ah, 0x0e
.loop:
    lodsb
    or al,al
    jz halt
    int 0x10
    jmp .loop
halt:
    cli
    hlt
hello: db "Aditya!",0
times 510 - ($-$) db 0
dw 0xaa55
```



The screenshot shows the same text editor window, but the code is now commented and formatted for readability. The code is as follows:

```
[BITS 16]          ;Tells the assembler that its a 16 bit code
[ORG 0x7C00]       ;Origin, tell the assembler that where the code will
                  ;be in memory after it is been loaded

MOV AL, 65
CALL PrintCharacter
JMP $              ;Infinite loop, hang it here.

PrintCharacter:    ;Procedure to print character on screen
                  ;Assume that ASCII value is in register AL
MOV AH, 0x0E      ;Tell BIOS that we need to print one charater on screen.
MOV BH, 0x00      ;Page no.
MOV BL, 0x07      ;Text attribute 0x07 is lightgrey font on black background

INT 0x10          ;Call video interrupt
RET               ;Return to calling procedure

TIMES 510 - ($ - $$) db 0      ;Fill the rest of sector with 0
DW 0xAA55             ;Add boot signature at the end of bootloader
```

The status bar at the bottom indicates "Plain Text", "Spaces: 4", "Ln 20, Col 77", and "INS".

Compile the second bootloader file and run using the emulator

```
ex5@208-14ThinkStation-P348: ~/Documents/23brs1157
File Edit View Search Terminal Help
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ nasm secondBootLoader.asm -f
bin -o boot2.bin
ex5@208-14ThinkStation-P348:~/Documents/23brs1157$ qemu-system-x86_64 -drive fil
e=boot2.bin,index=0,media=disk,format=raw
```

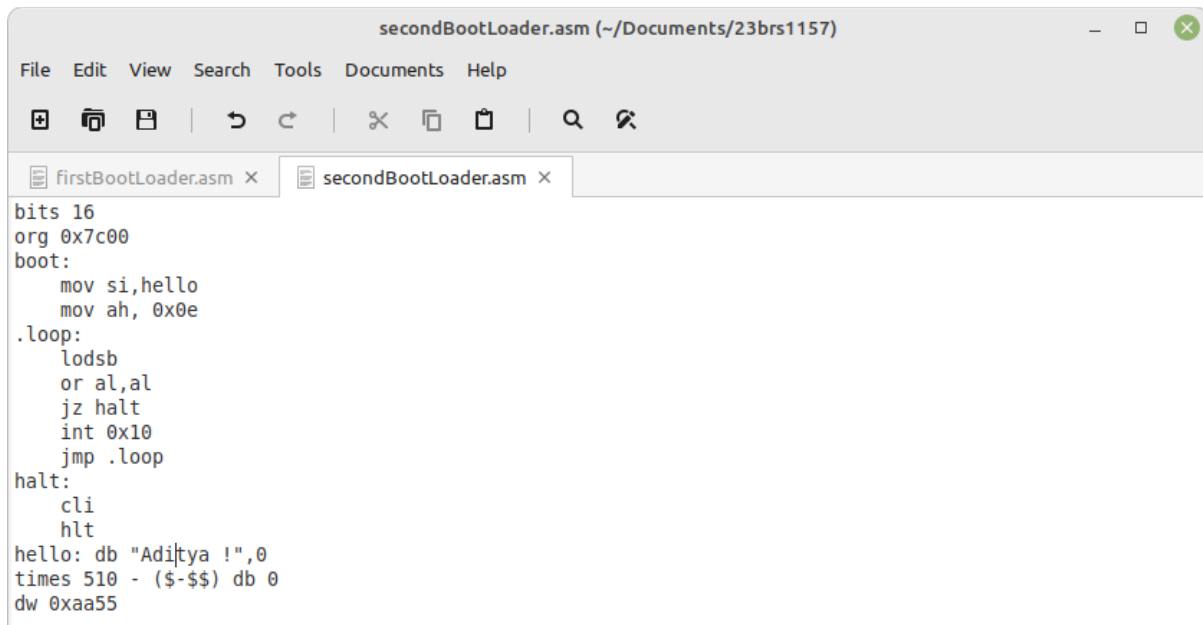
Output :

```
QEMU
Machine View
SeaBIOS (version 1.13.0-1ubuntu1.1)

iPXE (http://ipxe.org) 00:03.0 CA00 PCI2.10 PnP PMM+07F8CB00+07ECCB00 CA00

Booting from Hard Disk...
A!_
```

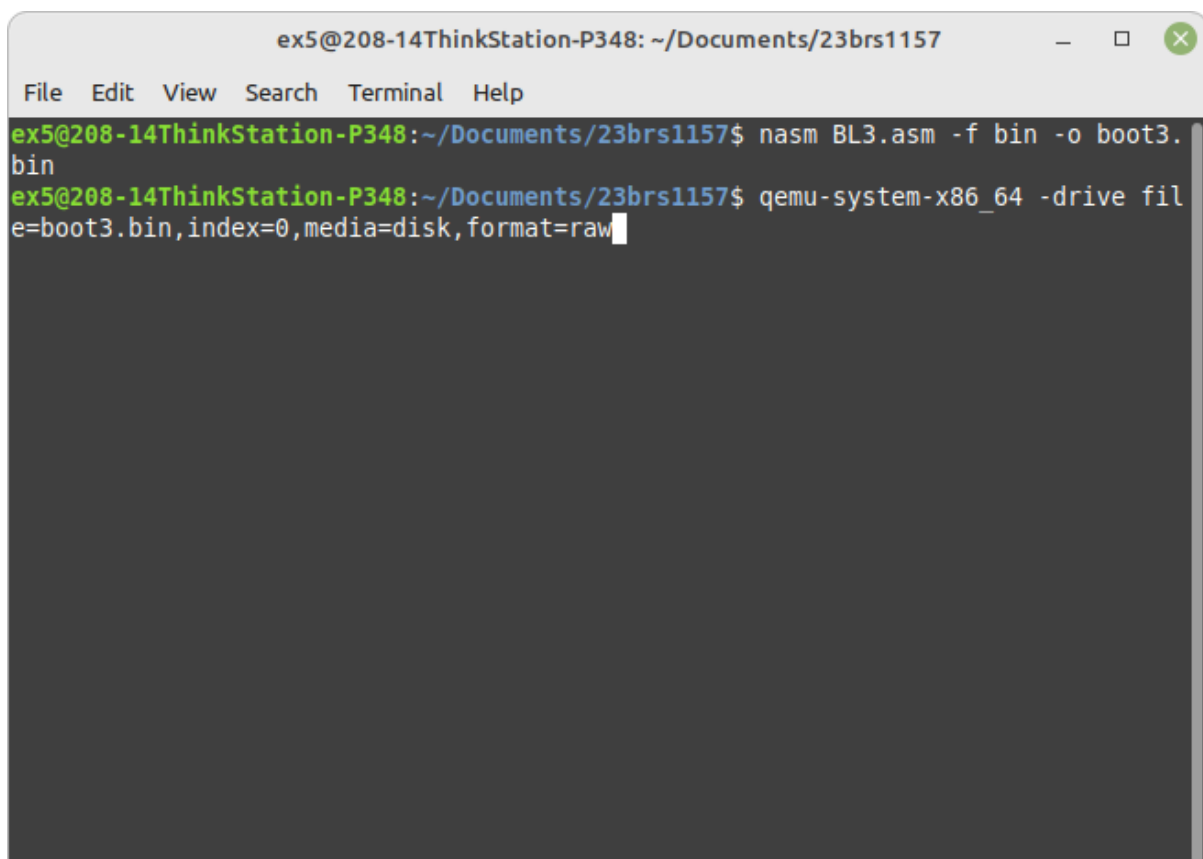
Create a new third bootloader program which prints your name



The screenshot shows a text editor window titled "secondBootLoader.asm (~/.Documents/23brs1157)". The editor has a menu bar with "File", "Edit", "View", "Search", "Tools", "Documents", and "Help". Below the menu bar is a toolbar with icons for file operations and editing. The editor displays two tabs: "firstBootLoader.asm" and "secondBootLoader.asm". The code in the "secondBootLoader.asm" tab is as follows:

```
bits 16
org 0x7c00
boot:
    mov si,hello
    mov ah, 0x0e
.loop:
    lodsb
    or al,al
    jz halt
    int 0x10
    jmp .loop
halt:
    cli
    hlt
hello: db "Aditya !",0
times 510 - ($-$$) db 0
dw 0xaa55
```

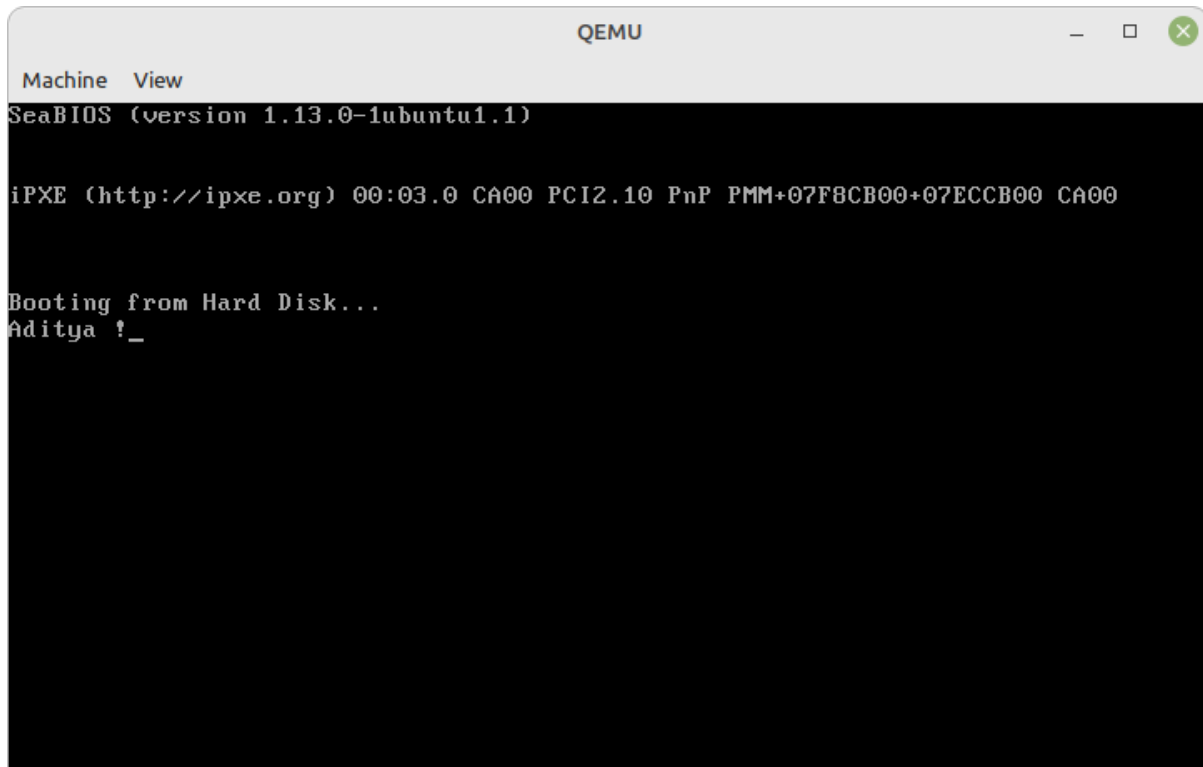
Compile and run the file using emulator



The screenshot shows a terminal window titled "ex5@208-14ThinkStation-P348: ~/.Documents/23brs1157". The terminal has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The terminal displays the following commands and their output:

```
ex5@208-14ThinkStation-P348:~/.Documents/23brs1157$ nasm BL3.asm -f bin -o boot3.bin
ex5@208-14ThinkStation-P348:~/.Documents/23brs1157$ qemu-system-x86_64 -drive file=boot3.bin,index=0,media=disk,format=raw
```

Output :



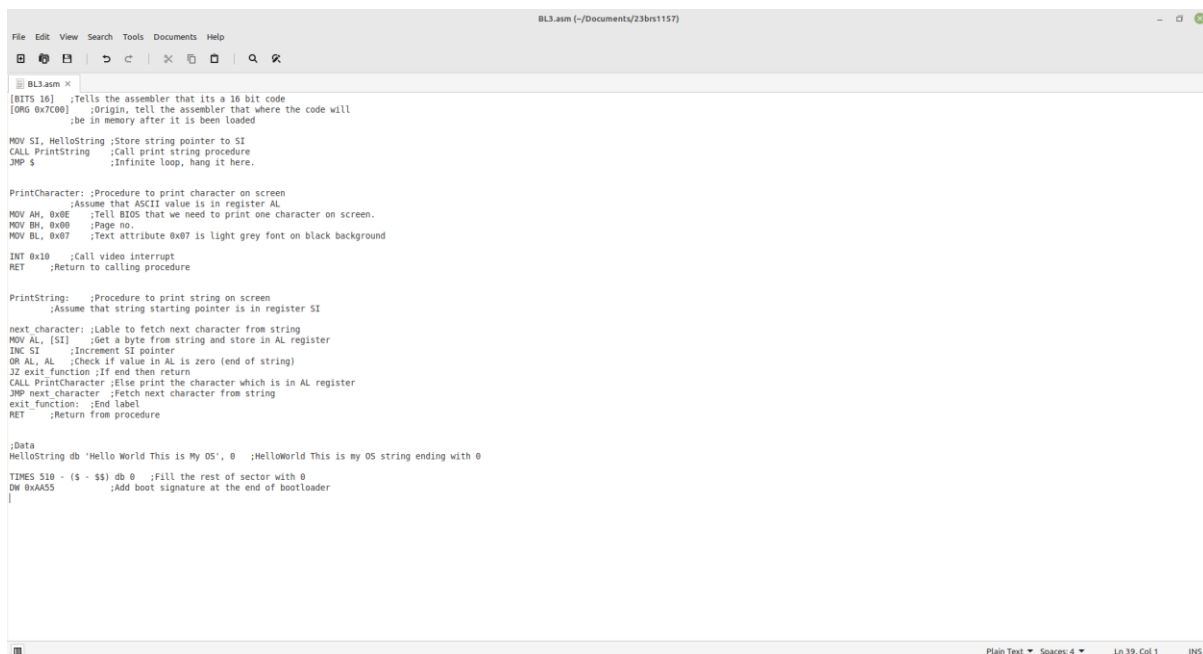
The screenshot shows a QEMU window titled "QEMU" with a menu bar (Machine, View). The main display area shows the SeaBIOS boot process. The text on the screen is as follows:

```
SeaBIOS (version 1.13.0-1ubuntu1.1)

iPXE (http://ipxe.org) 00:03.0 CA00 PCI2.10 PnP PMM+07F8CB00+07ECCB00 CA00

Booting from Hard Disk...
Aditya !_
```

Another program for printing 'Hello World This is My OS'



The screenshot shows a text editor window titled "BL3.asm (~/.Documents/23brs1157)". The code is written in assembly and includes comments. The code is as follows:

```
BL3.asm x
[BITS 16] ;Tells the assembler that its a 16 bit code
[ORG 0x7C00] ;origin, tell the assembler that where the code will
;be in memory after it is been loaded

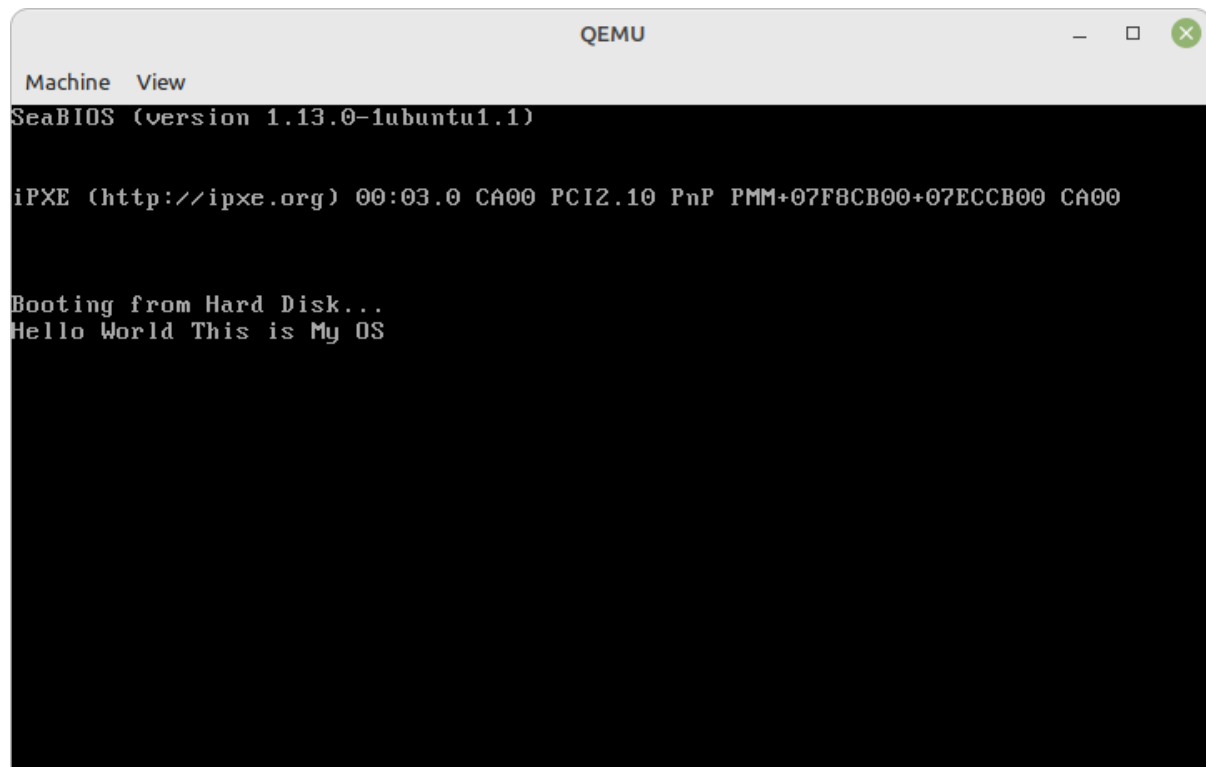
MOV SI, HelloString ;Store string pointer to SI
CALL PrintString ;Call print string procedure
JMP $ ;Infinite loop, hang it here.

PrintCharacter: ;Procedure to print character on screen
;Assume that ASCII value is in register AL
MOV AH, 0x0E ;Tell BIOS that we need to print one character on screen.
MOV BH, 0x00 ;Page no.
MOV BL, 0x07 ;Text attribute 0x07 is light grey font on black background
INT 0x10 ;Call video interrupt
RET ;Return to calling procedure

PrintString: ;Procedure to print string on screen
;Assume that string starting pointer is in register SI
next character: ;Label to fetch next character from string
MOV AL, [SI] ;Get a byte from string and store in AL register
INC SI ;Increment SI pointer
OR AL, AL ;Check if value in AL is zero (end of string)
JZ exit function ;If end then return
CALL PrintCharacter ;Else print the character which is in AL register
JMP next character ;Fetch next character from string
exit function: ;End label
RET ;Return from procedure

;Data
HelloString db 'Hello World This is My OS', 0 ;HelloWorld This is my OS string ending with 0
TIMES 510 - ($ - $$) db 0 ;Fill the rest of sector with 0
DW 0xAA55 ;Add boot signature at the end of bootloader
|
```

Output :



The image shows a terminal window titled "QEMU" with standard window controls. Inside the terminal, the output of a virtual machine boot is displayed in a monospaced font. The text shows the SeaBIOS version, the iPXE boot loader configuration, and the successful booting from a hard disk, followed by a custom message.

```
Machine  View
SeaBIOS (version 1.13.0-1ubuntu1.1)

iPXE (http://ipxe.org) 00:03.0 CA00 PCI2.10 PnP PMM+07F8CB00+07ECCB00 CA00

Booting from Hard Disk...
Hello World This is My OS
```