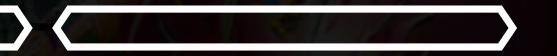
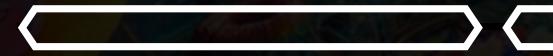


++++++



DONUT-OS

Um Sistema Operacional Portátil para Monitoramento de Redes



++++++



MARCOS
LOMMEZ



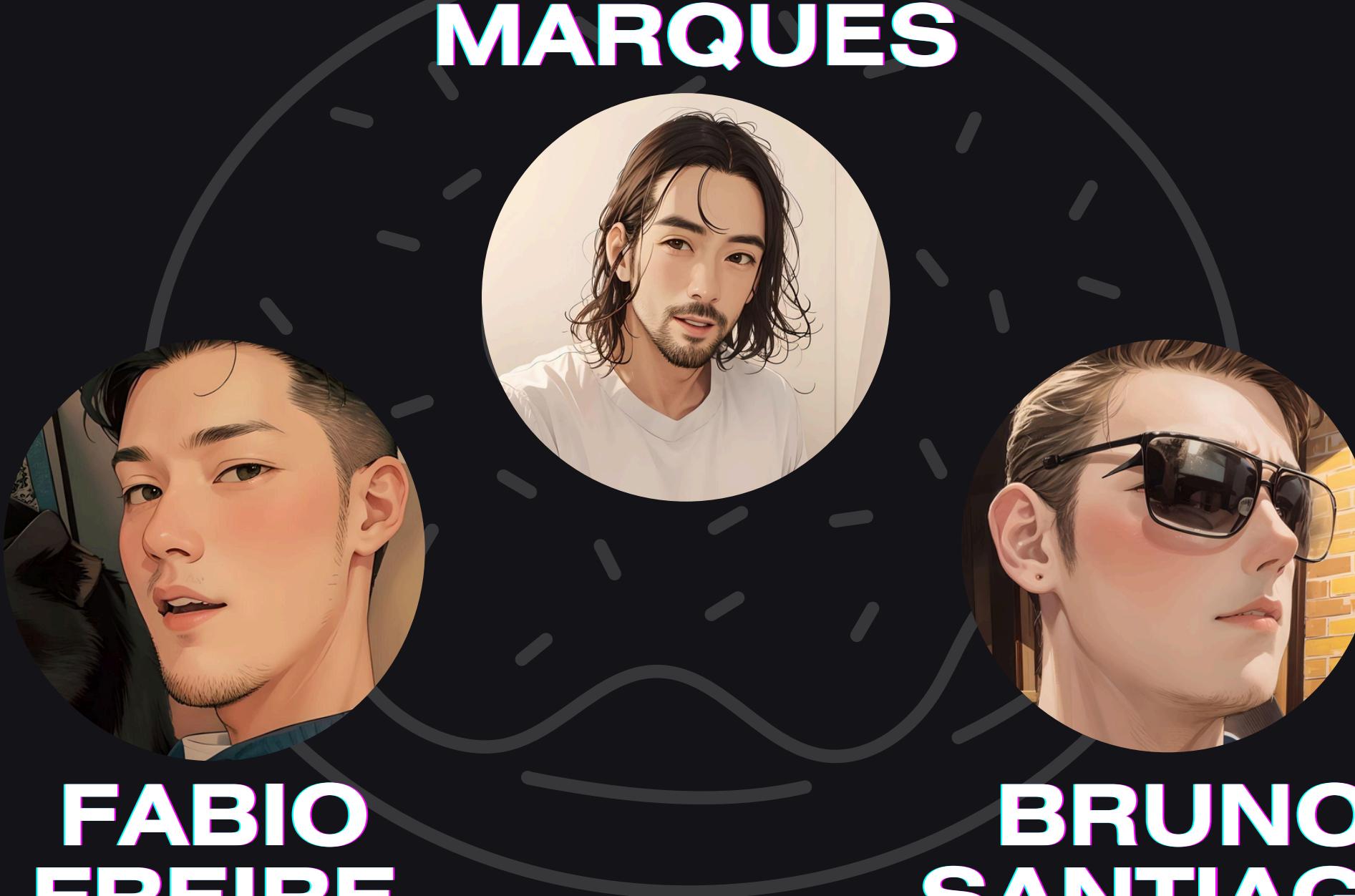
BERNARDO
MARQUES



SAULO DE
MOURA



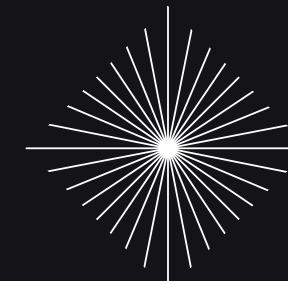
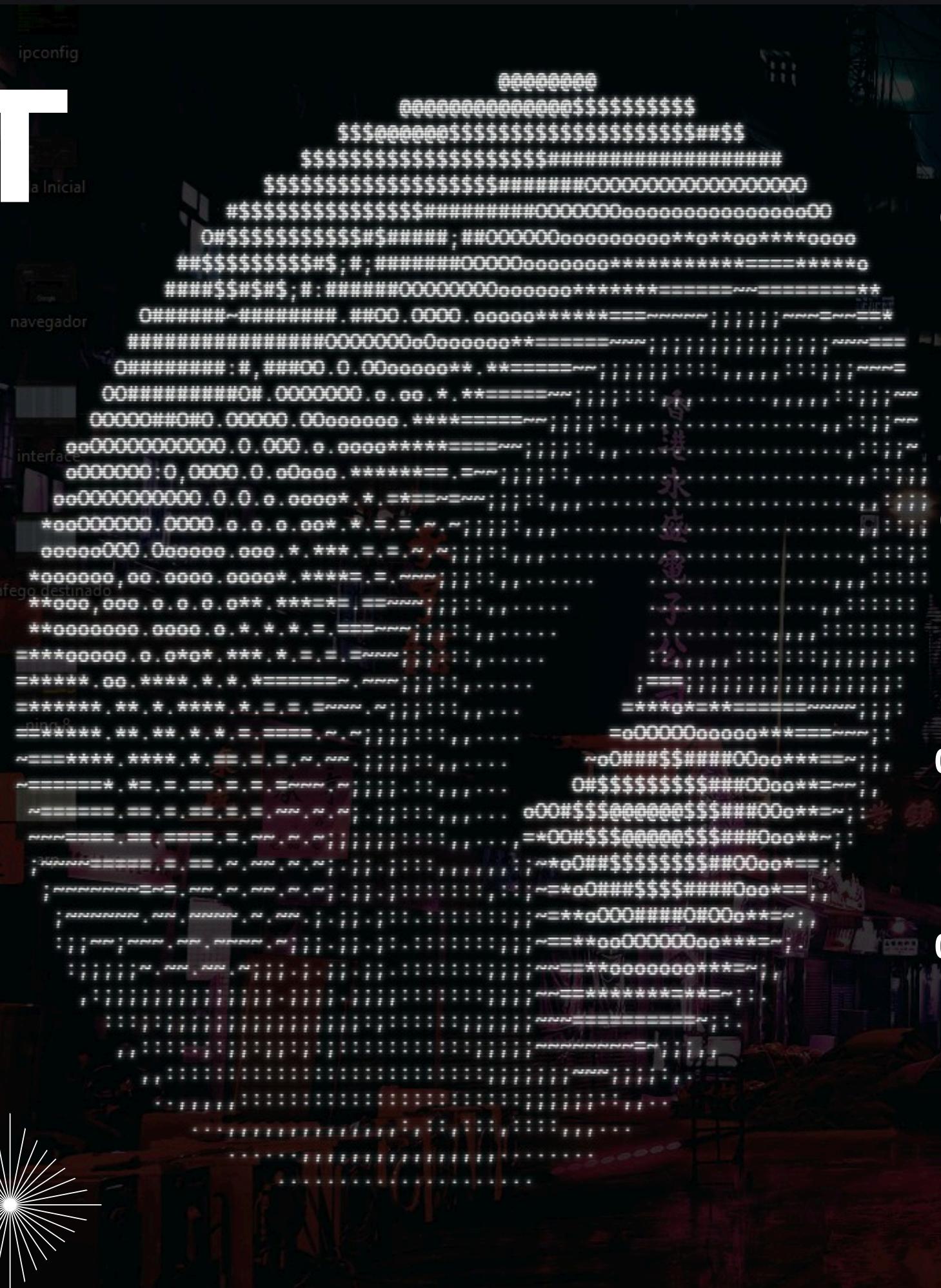
FABIO
FREIRE



BRUNO
SANTIAGO



DONUT OS



01 SISTEMA OPERACIONAL PORTATIL

- Pendrive
- VM

02 SNIFFER DE REDE

- Análise de pacotes
- Visualização da rede

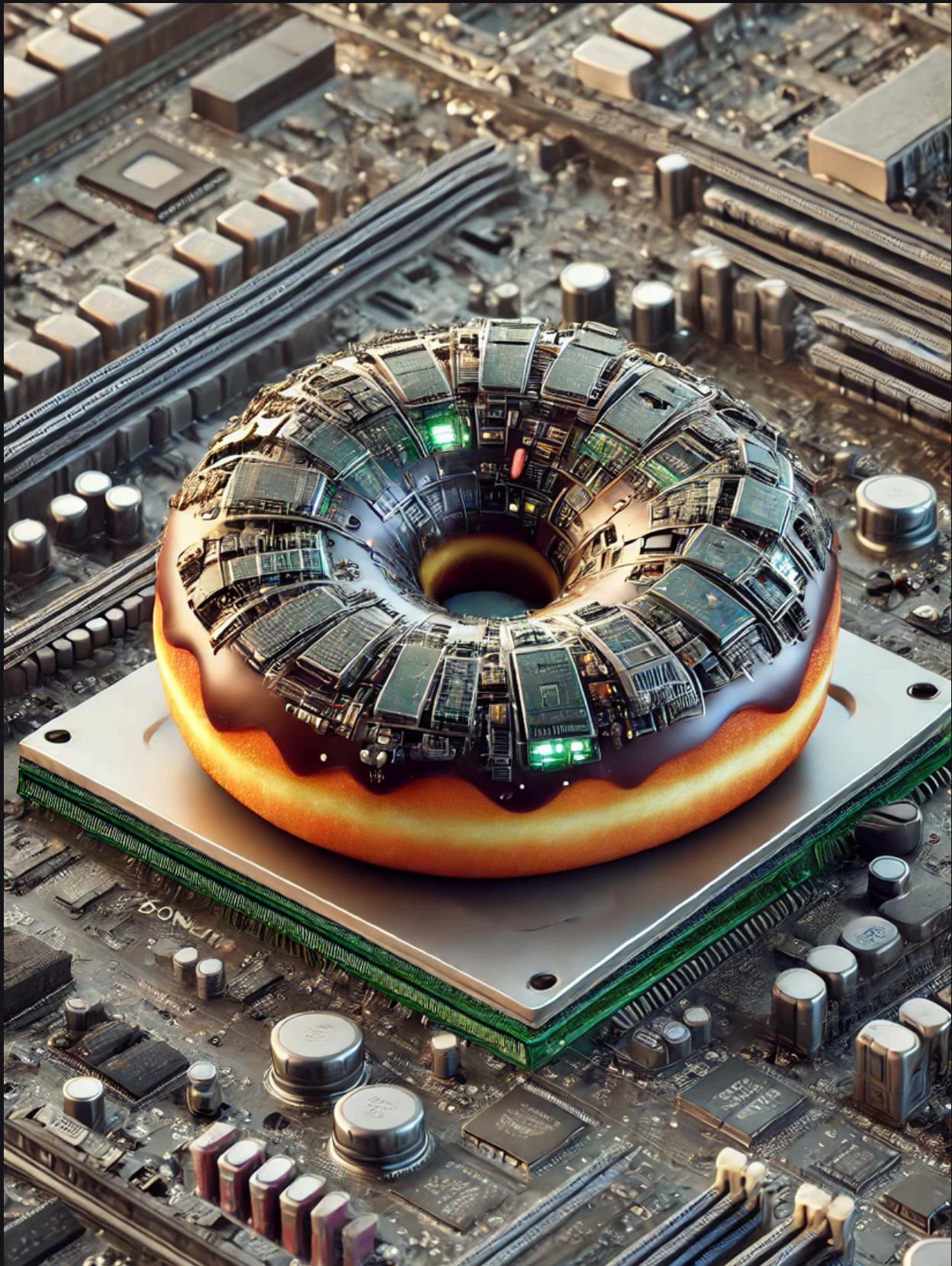
03 DONUT



04 COMPARATIVOS

- Wireshark
- Nanvix
- AmogOS
- TetrisOS

++++++



AMBIENTE

- 00 QEMU
- 01 GCC CROSS COMPILER
- 02 NASM
- 03 128 MB
- 04 I386 (X86)
- 05 32 BITS - PROTECTED MODE
- 06 8259 PIC / PIT / PS-2 KEYBOARD
- 07 RTL8139
- 07 TAP - TERMINAL ACCESS POINT



OBJETIVOS

- DISPOSITIVO BOOTÁVEL
- IMPLEMENTAÇÃO DE LIBS EM C
- DESIGN
- DRIVERS DE REDE
- SNIFFER DE REDE
- ESCALONAMENTO DE PROCESSOS
- RODAR O DONUT



OBJETIVOS

- ✓ → DISPOSITIVO BOOTÁVEL
- ✓ → IMPLEMENTAÇÃO DE LIBS EM C
- ✓ → DESIGN
- ✓ → DRIVERS DE REDE
- ✓ → SNIFFER DE REDE
- ✓ → ESCALONAMENTO DE PROCESSOS
- ✓ → RODAR O DONUT



++++++

FUNÇÕES DO SO



- TTY PROMPT
- PROCESSOS & PAGINAÇÃO
- ESCALONAMENTO ROUND-ROBIN
- SESSÕES CRÍTICAS
- TROCA DE CONTEXTO
- EXCEÇÕES BLUE SCREEN OF DEATH
- INTERRUPTS
- DRIVERS TECLADO / REDE / TIMER
- DONUT 🍩



TERMINAL



>help
help - show this command
about - print system info
clear - clears the screen
donut - spin the donut
die - throw an error
color - set screen color
rand - print random number
pci - scan pci bus
ram - ram usage
dev - device status
print - packet print
net - start net device
paging - test paging
process - test process
\$? - print out last error code
>

DONUT

A screenshot of a QEMU terminal window titled "QEMU". The window displays a large, intricate piece of ASCII art representing a dollar sign (\$) composed of various symbols like asterisks (*), hash (#), and dollar signs (\$). The art is centered and spans most of the screen area.



PROCESSOS

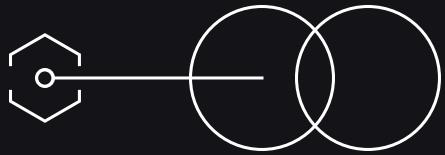
```
pid: 0 {
    gs: 0x00000010, fs: 0x00000010, es: 0x00000010, ds: 0x00000010,
    edi: 0x00000000, esi: 0x00000000, ebp: 0x0007fd8, esp: 0x0007fd68,
    ebx: 0x0000010a, edx: 0x00000000, ecx: 0x000b8000, eax: 0x00000000,
    int_no: 0x00000020, err_no: 0x00000000, eip: 0x0000c6af, cs: 0x00000008,
    eflags: 0x00000246, useresp: 0x24242424, ss: 0x23242424
}

pid: 1 {
    gs: 0x00000010, fs: 0x00000010, es: 0x00000010, ds: 0x00000010,
    edi: 0x00000000, esi: 0x00000000, ebp: 0x0007fd8c, esp: 0x0007fd68,
    ebx: 0x00000000, edx: 0x00000000, ecx: 0x00000000, eax: 0x0000845d,
    int_no: 0x00000020, err_no: 0x00000000, eip: 0x0000846a, cs: 0x00000008,
    eflags: 0x00000282, useresp: 0x00000000, ss: 0x00000000
}

pid: 0 {
    gs: 0x00000010, fs: 0x00000010, es: 0x00000010, ds: 0x00000010,
    edi: 0x00000000, esi: 0x00000000, ebp: 0x0007fd8, esp: 0x0007fd68,
    ebx: 0x0000010a, edx: 0x00000000, ecx: 0x000b8000, eax: 0x00000000,
    int_no: 0x00000020, err_no: 0x00000000, eip: 0x0000c6bb, cs: 0x00000008,
    eflags: 0x00000293, useresp: 0x24242424, ss: 0x23242424
}
```



PAGINAÇÃO



```
QEMU  
Machine View  
>paging  
User pages allocated:  
=====  
Page 800: 0x00320000  
Page 801: 0x00321000  
Page 802: 0x00322000  
Page 803: 0x00323000  
Page 804: 0x00324000  
Page 805: 0x00325000  
Page 806: 0x00326000  
Page 807: 0x00327000  
Page 808: 0x00328000  
Page 809: 0x00329000  
Page 810: 0x0032a000  
Page 811: 0x0032b000  
=====  
>
```

EXCEÇÕES

```
QEMU  
Machine View - x  
Error and whatnot  
no: 14  
msg: Page Fault
```



ESCALONAMENTO

```
-: 33 static int process_x() {
32     unsigned int x = 0;
31     printf("x start\n");
30     while(1) {
29         x++;
28         if(x % 5000000 == 0) {
27             printf("x = %d timer = %d\n", x, (int)timer_get());
26         }
25     }
24     return 0;
23 }
22
21 static int process_y() {
20     unsigned int y = 0;
19     printf("y start\n");
18     while(1) {
17         y--;
16         if(y % 5000000 == 0) {
15             printf("y = %d timer = %d\n", y, (int)timer_get());
14         }
13     }
12     return 0;
11 }
```

X QEMU

Machine View

x	timer
1150000000	95121
3144967296	95135
1200000000	95612
3094967296	95626
1250000000	96113
3044967296	96118
2994967296	96585
1300000000	96603
1350000000	97072
2944967296	97077
1400000000	97565
2894967296	97570
2844967296	98037
1450000000	98055
1500000000	98525
2794967296	98533
1550000000	99021
2744967296	99029
1600000000	99512
2694967296	99521
1650000000	100039
2644967296	100046
1700000000	100529
2594967296	100542



SNIFFER DE REDE

+++++

```
QEMU
Machine View
Number of packets: 30
Selected index: 9
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:0002
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:0016
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:00fb
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:0016
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:00fb
IPv4 Source IP: 10.0.0.2
Dest IP: 224.0.0.251
IPv4 Source IP: 10.0.0.2
Dest IP: 224.0.0.251
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:00fb
IPv4 Source IP: 10.0.0.2
Dest IP: 224.0.0.251
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:0016
IPv6 Source IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
Dest IP: ff02:0000:0000:0000:0000:0000:0000:00fb
```



LEITURA DE PACOTES

++++
++++
++++
++++
++++
++++
++++
++++
++++

```
X QEMU
Machine View
ETHERNET HEADER
SOURCE MAC: 06:77:61:08:f1:97
DESTINATION MAC: 01:00:5e:00:00:fb

NETWORK PROTOCOL: IPv4
VERSION: 4
HEADER LENGTH: 5
TYPE OF SERVICE: 0
TOTAL LENGTH: 168
IDENTIFICATION: 3770
FLAGS FRAGMENT OFFSET: 16384
TTL: 255
PROTOCOL: 17
HEADER CHECKSUM: 33165
SOURCE IP: 10.0.0.2
DEST IP: 224.0.0.251
PROTOCOL: UDP
SOURCE PORT: 5353
DEST PORT: 5353
LENGTH: 148
CHECKSUM: 58155
```

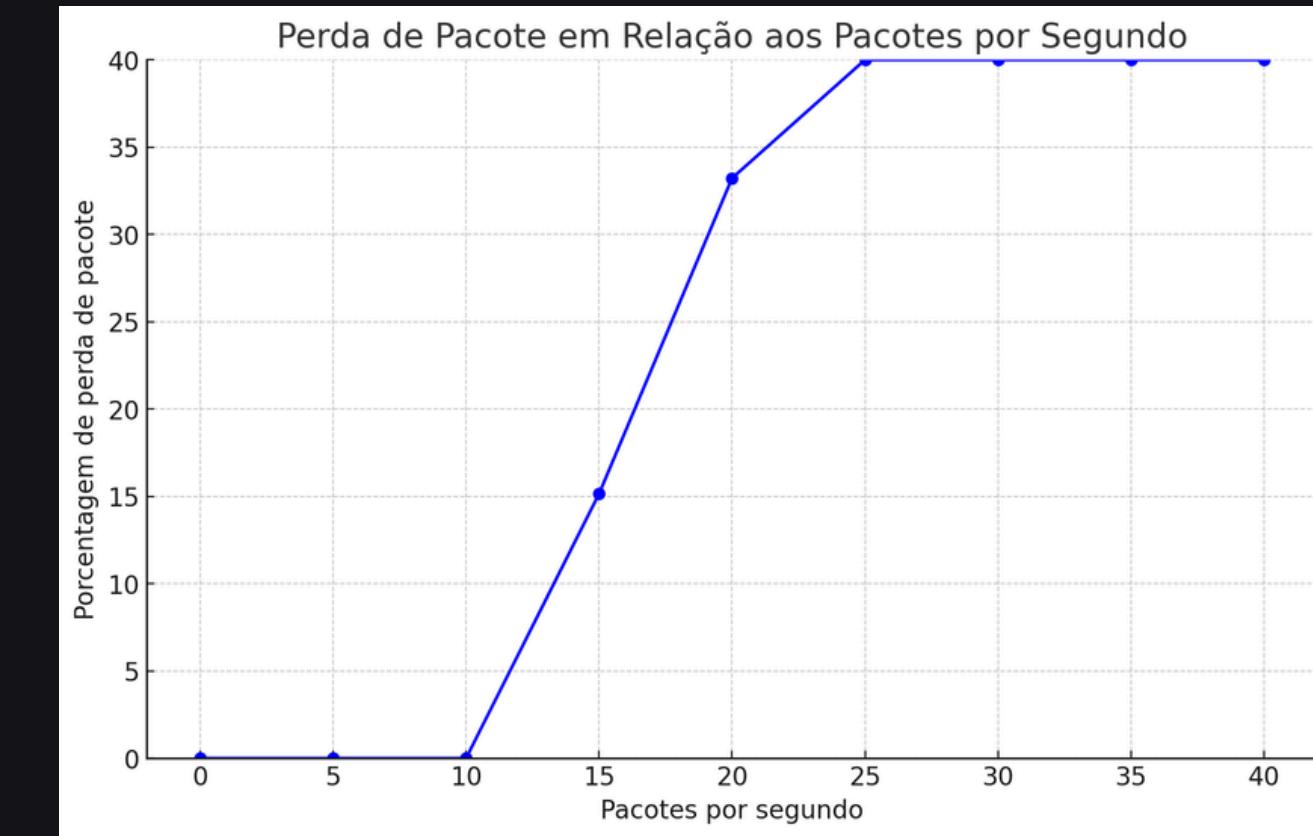


```
X QEMU
Machine View
ETHERNET HEADER
SOURCE MAC: 06:77:61:08:f1:97
DESTINATION MAC: 33:33:00:00:00:16

NETWORK PROTOCOL: IPv6
VERSION: 0
CLASS: 0
FLOW LABEL: 96
PAYLOAD LENGTH: 9216
NEXT HEADER: 0
HOP LIMIT: 1
SOURCE IP: fe80:0000:0000:0000:0477:61ff:fe08:f197
DEST IP: ff02:0000:0000:0000:0000:0000:0000:0016
PROTOCOL: HOPOPT
NEXT HEADER: 58
HEADER EXT LENGTH: 0
OPTIONS: 050200000100
PADDING: 8f00
NEXT HEADER: ICMPv6
TYPE: 143
CODE: 0
CHECKSUM: 10578
```

MÉTRICAS

- **1056KB DE SISTEMA OPERACIONAL**
- **1600 ATUALIZAÇÕES DE TELA POR SEGUNDO (QEMU + RYZEN 5 3600X)**
- **ESTABILIDADE DE PACOTES ATÉ 10 FRAMES POR SEGUNDO**



QEMU - Press Ctrl+Alt+G to release grab

```
Machine View
>ram
Total = 14680064B, used = 32728B (0.222941 %)
>
```

QEMU - Press Ctrl+Alt+G to release grab

```
Machine View
Screen clears per second: 1561.767921
Screen clears total: 10000
Start = 1174, End = 7577
```



CONCLUSÕES

- ✓ UM SISTEMA OPERACIONAL LEVE,
 - ✓ SIMPLES, ESCALÁVEL PARA APLICAÇÕES
 - ✓ PERSONALIZADAS, CONTANDO COM UM
 - ✓ SISTEMA BASE DE REDES E PROCESSOS
-
- ✗ MELHORIAS SE FAZEM NECESSÁRIAS NO
 - ✗ DRIVER DE REDE PARA SUPORTAR ALTA DEMANDA DE PACOTES



TRABALHOS FUTUROS

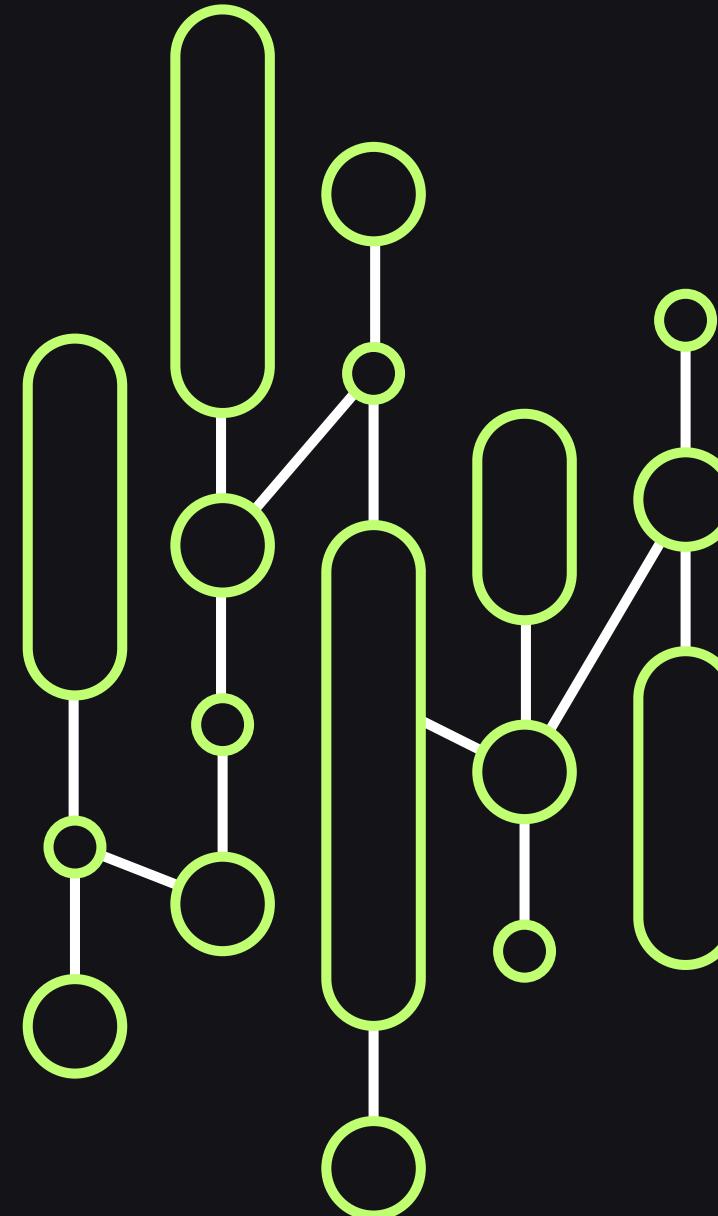


- 00 PORTABILIDADE PARA OUTRAS ARQUITETURAS
- 01 SISTEMA DE ACESSOS REMOTOS AO SISTEMA
- 02 SYSCALLS E COMPILADORES
- 03 PROCESSADOR EM 64BITS MODE
- 04 ACELERAR O PROCESSAMENTO DE QUADROS



REFERÊNCIAS

- wiki.osdev.org
- MelLOS, TetrisOS, Nanvix, edu OS
- Sistemas Operacionais - UFRGS - Oliveira, carissimi, toscani
- Wireshark
- Redes de Computadores - Tanenbaum, Wetherall
- Itamaracá - Daniel. H. Pereira
- Donut - Andy Sloane - 2006



OBRIGADO!

DONUT OS: [HTTPS://GITHUB.COM/BERNARDO46-2/DONUTOS](https://github.com/BERNARDO46-2/DONUTOS)