CMPT 432
Team 00

BuddyOS

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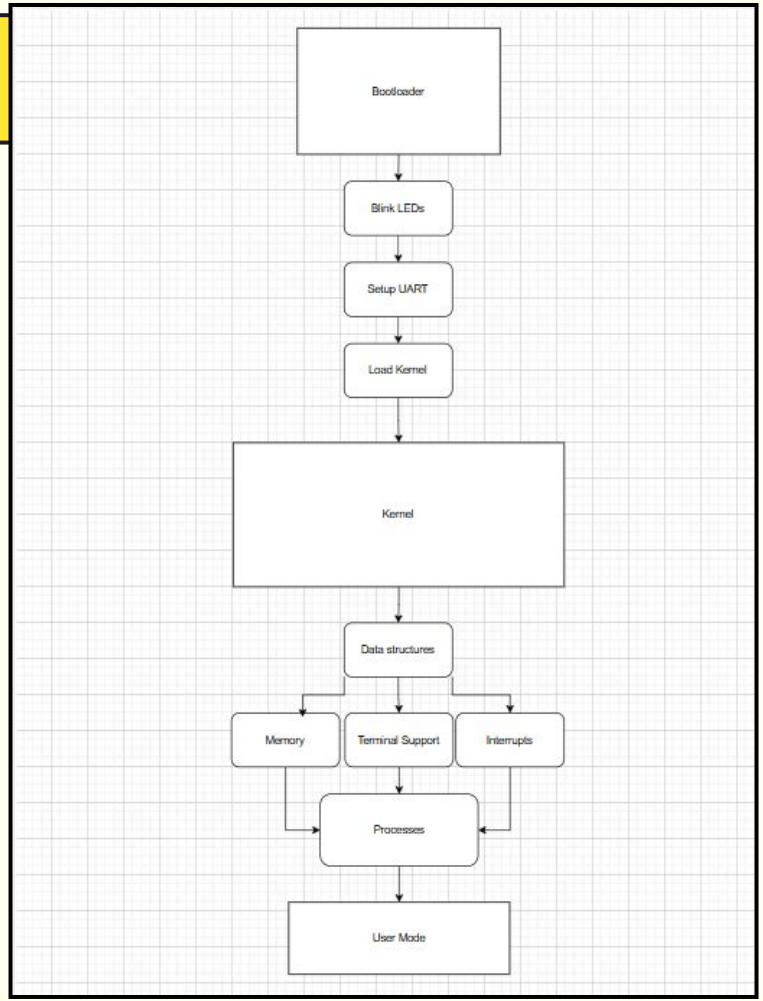
MVP

- Booting from our own bootloader ✅
- Basic interrupt handling ✅
- Bare bones memory management ✅
  - Physical memory management
  - Allocated with a slab allocator
- Single-level FAT12 filesystem ✅
- FCFS scheduler ✅✅✅
- At least two running processes ✅✅✅
- Shell interface ✅
- IPC ✅



NTH

- Preemptive RR scheduler ✅
- Ethernet driver & Network stack (UDP) ✅
- VFS ✅
- Variable number of processes ✅

All of our MVP and NTH are completed!! YIPPEE!!

Bootloader

Bootloader Timeline

- Config PLLs
- Init Interrupts
- Init DDR
- Init LEDs
- Init UART
- Init SD card driver
- Init FAT12 Filesystem
- Load Kernel From Filesystem to DDR
- Context Switch to Kernel

SD card driver API

- void MMCwriteblock(uint32_t block, uint32_t* buf)
- void MMCreadblock(uint32_t block, uint32_t* buf)

Kernel Flow (syscalls/irq)

Dispatcher <---> Processes

- Preemption and context switching via system calls and interrupts

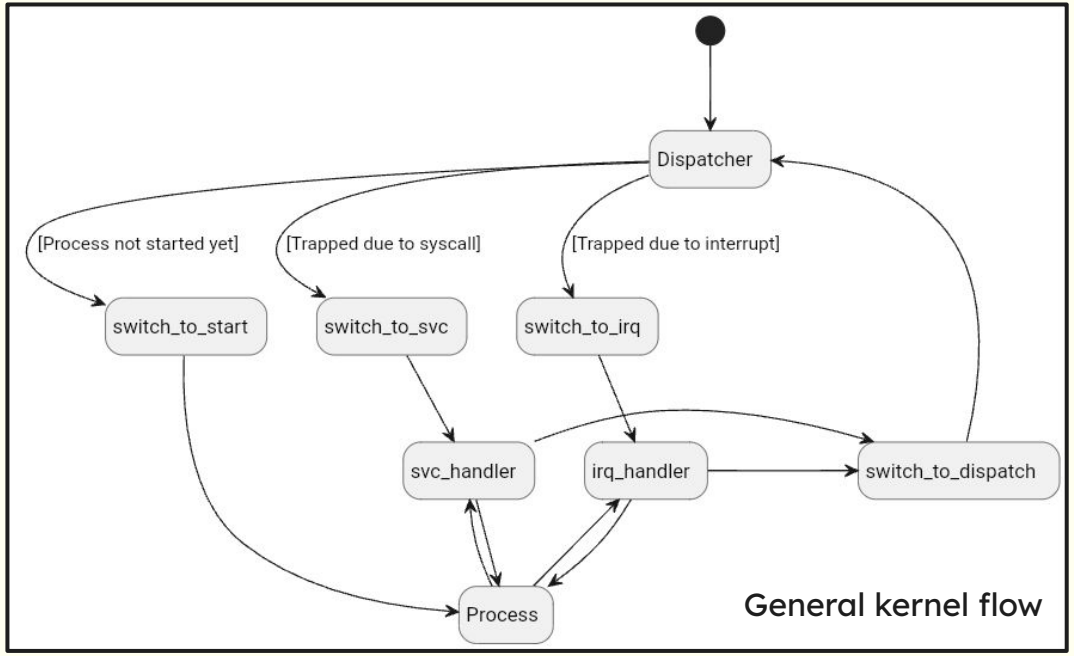
Reinstall new vector table in kernel

System calls

Interrupts

- UART Interrupt
- Timer Interrupt

Exception stacks for each process in SRAM loaded during ***mode switches*** to SVC and IRQ mode

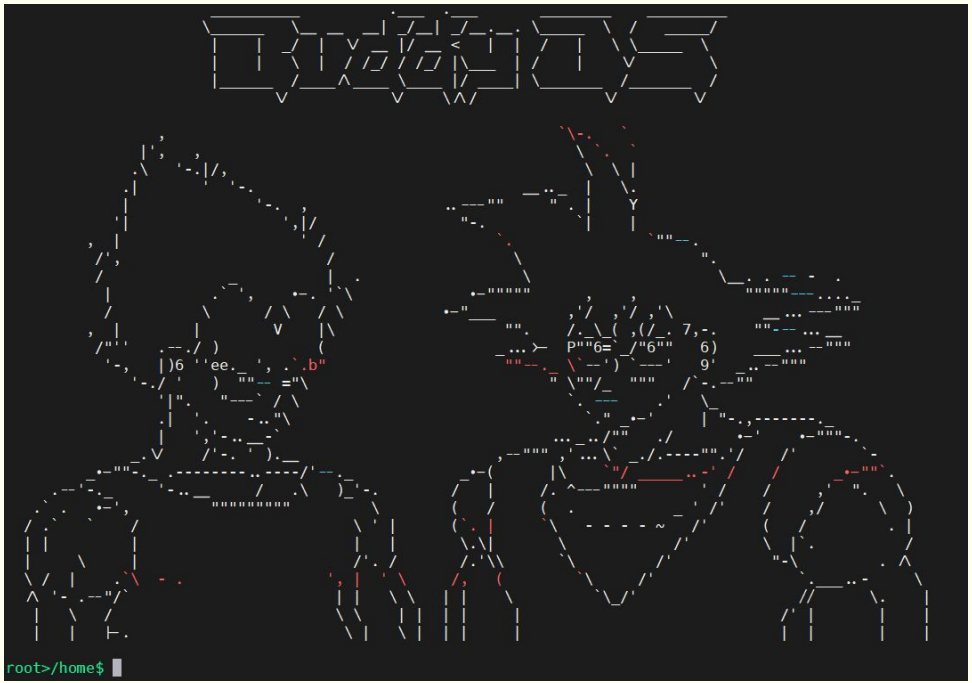


UART

- Baud Rate: 115200

- UART API
  - uart0_init()
  - uart0_putch(char c)
  - uart0_puts(const char* str)
  - uart0_putsln(const char* str)
  - uart0_printitoa(int num)
  - uart0_printf(const char* str, …)
  - uart0_getch()
  - uart0_poll()
  - uart0_fgets(char* str, int n, int stream)

Shell

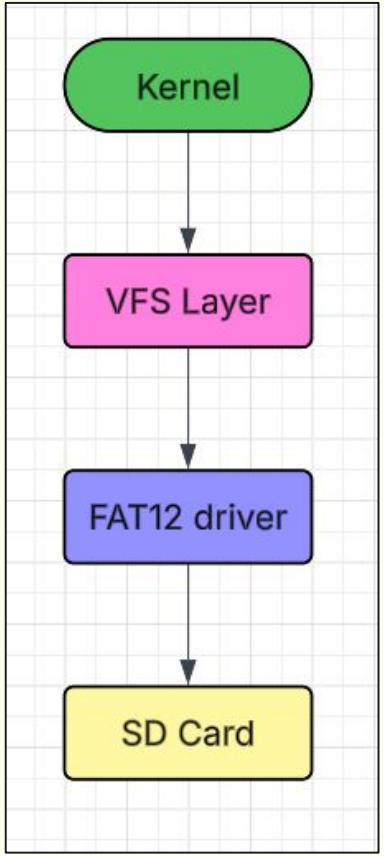



```
root>/home$ help
Available commands
help - shows this message
exit - exits the shell
ls - displays file system
clear - clears terminal
cat - display contents of file
echo <text> - prints text to terminal
```

Filesystem

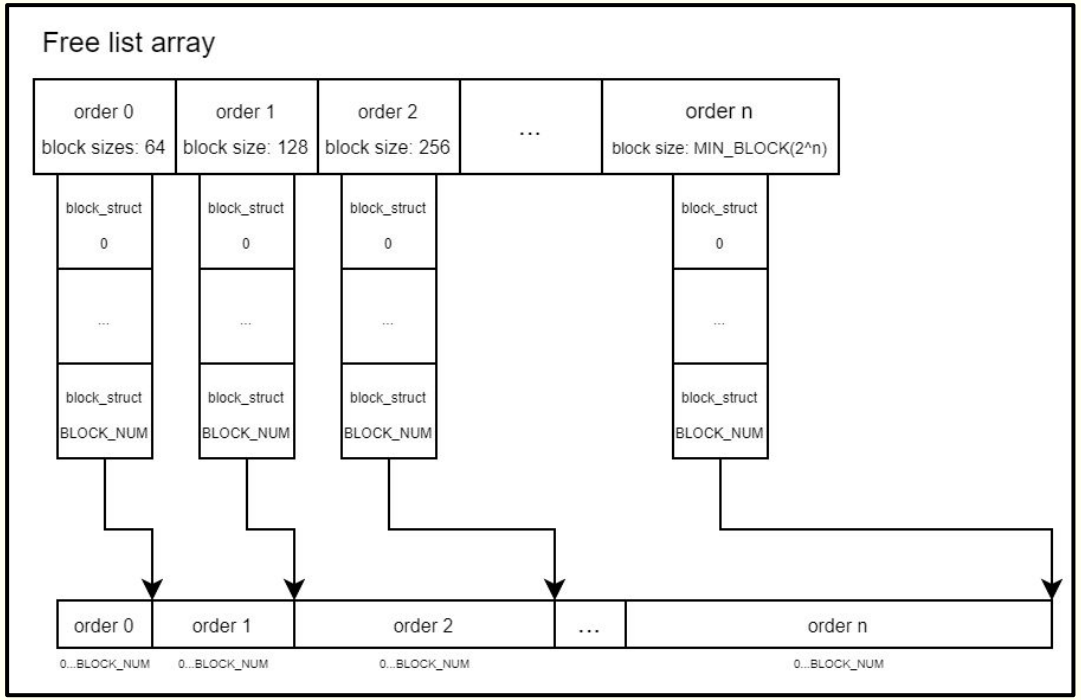
- BuddyOS uses a Virtual File System (VFS) as a layer of abstraction

- VFS API
  - vfs_mount(): Mounts fs at a target path
  - vfs_open(): Loads a file into memory and returns an fd
  - vfs_read(): Read from a file using fd
  - vfs_write(): Write to a file using fd
  - vfs_close(): Free resources and write back to disk



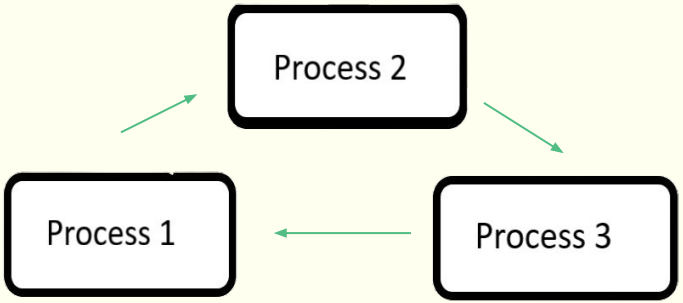
Memory

- Slab/Buddy inspired allocation
  - array of free lists, malloc pops, free pushes
- Physical memory is partitioned into orders
- Each order is a free list of pre-allocated memory blocks
- Data corresponding to each block is stored within the free block itself
- O(1) memory overhead and O(1) time allocation/free
- Sizes are variable and can all be changed easily via macros (as long as it's a power of 2)



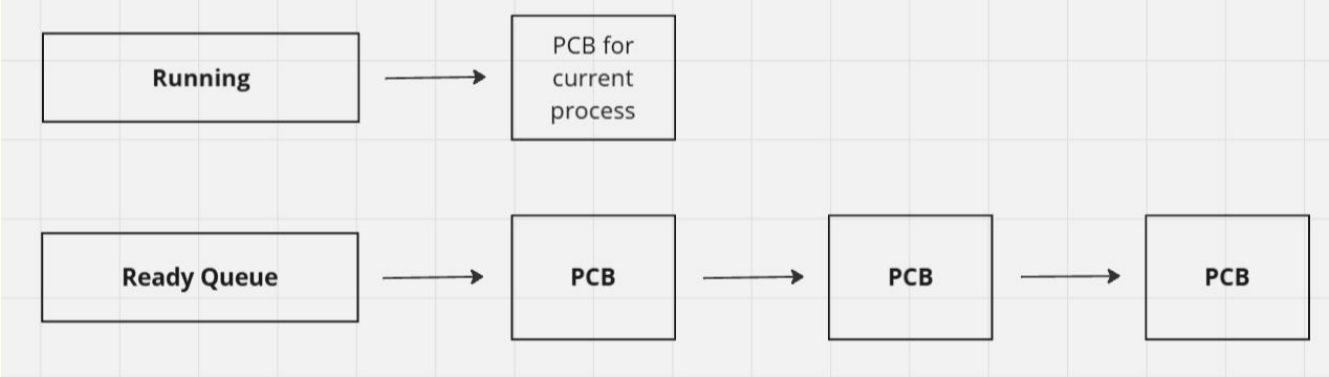
Scheduler

- Round-Robin (RR) scheduler
- Each process is given a specific quantum to operate within
- Support for different priorities
- Utilises context-switching to transition between user, system, and IRQ modes



Processes

- Processes are stored within a static process table
- Each process is given a PCB, that contains a separate struct containing its context
- PCB also contains state (READY, RUNNING, BLOCKED, etc.), PID, PPID (forked processes), stack information, trap_reason, a mailbox for IPC, and some other flags



User Mode

User Mode Processes

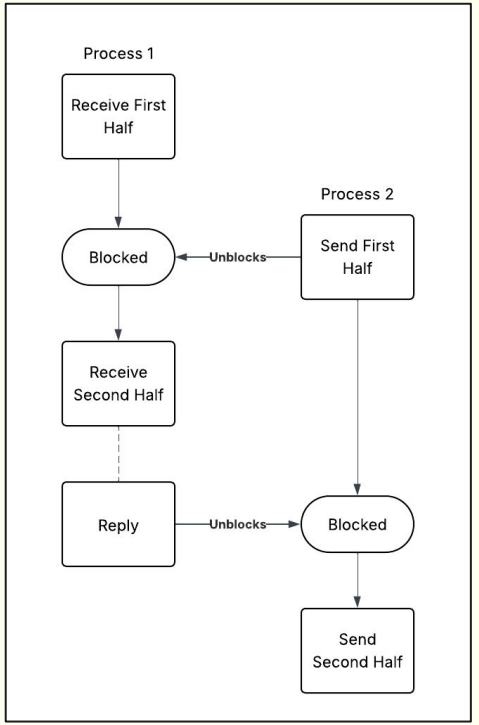
- Requires the use of system calls to request kernel resources
- Code for Processes Loadable from .bin files
- Supports semi-portable C programs

System Call API

- printf()
- fgets()
- malloc()
- free()
- poll()
- Socket syscalls
- IPC syscalls

IPC

- Blocking SRR-style IPC
  - With a msgwaits call
- Issues with blocking:
  - 1 Kernel Stack
  - No preemption in kernel
- Solution:
  - Split functions to handle calls that block



Ethernet

Ethernet API

- cpsw_recv()
- cpsw_transmit()

Ti Common Platform Ethernet Switch Driver

- Pin mux
- Config Control Registers
- Setup ALE and Port States
- Setup CPDMA queues

Microchip LAN8710A PHY Driver

- Use MDIO to communicate with PHY
- Reset PHY using GPIO pin 8
- PHY auto negotiation
- two connected devices choose common transmission parameters
- Set link parameters

Major Issues

- PHY does not power on and Needs to be reset using GPIO pin 8
- Interrupts are Masked, interrupt raw status register shows an interrupt occurs. Interrupt masked status register shows no interrupt occurs. Interrupt never gets signaled
- If port 2 is set to forward state it blocks multicast packets from being transmitted

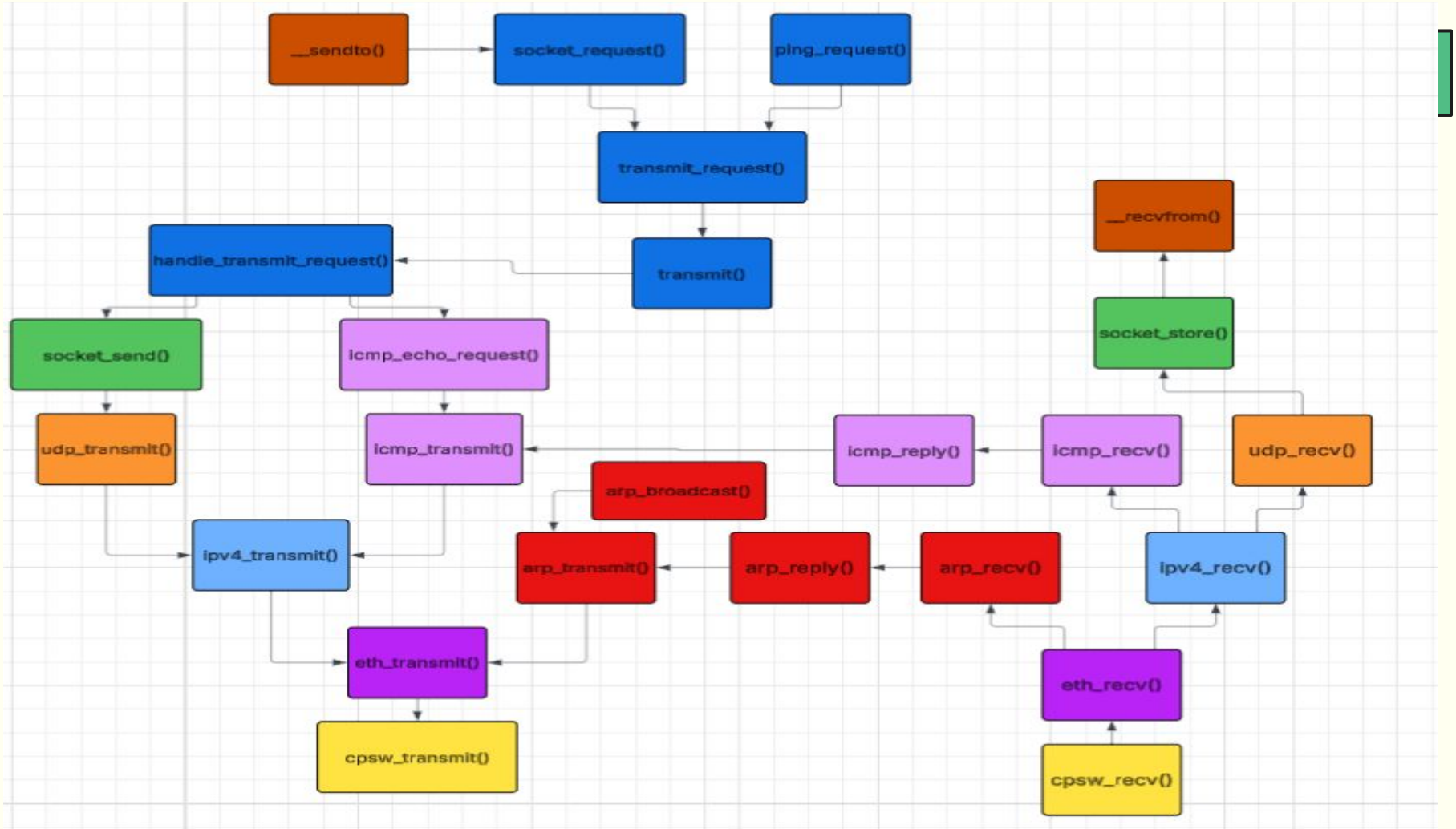
Network Stack

Supports

- Ethernet Headers
- ARP
  - Requests
  - Replies
- IPV4
- ICMP
  - Requests
  - Replies
- UDP
- Sockets

Socket API

- `__socket(int pid, uint8_t* gateway, uint8_t protocol)`
- `__bind(int soc, socket_info *soc_info)`
- `__closesocket(int soc)`
- `__recvfrom(int soc, uint8_t* buff)`
- `__sendto(int soc, uint8_t* frame, int size, socket_info *soc_info)`


__sendto()
socket_request()
ping_request()
transmit_request()
handle_transmit_request()
transmit()
__recvfrom()
socket_store()
socket_send()
icmp_echo_request()
udp_transmit()
icmp_transmit()
icmp_reply()
icmp_recv()
udp_recv()
arp_broadcast()
ipv4_transmit()
arp_transmit()
arp_reply()
arp_recv()
ipv4_recv()
eth_transmit()
eth_recv()
cpsw_transmit()
cpsw_recv()

I HATE WINDOWS
Marwan authored 5 minutes ago

man why did i have to find this bug
Marwan authored 33 minutes ago

fixed bugs caused by my incompetence
Aaron DSouza (aad921) authored 1 week ago

17

marwan noah pls help.....
Aaron DSouza (aad921) authored 1 month ago

Removed this damn FILE.H REFERENCE WE DONT EVEN HAVE A FIEL.H
kan728 authored 2 weeks ago

nevermind man
Emily Hartz-Kuzmicz (job346) authored 2 weeks ago

er im cooked. -NP
Noah Phonsavath authored Feb 20, 2025

being naked is no longer allowed with your buddies
Alexei Doell authored 1 week ago

We were all **Buddies** together

Board is going super sayian
Marwan authored 2 weeks ago and

buddy lives another day...
Alexei Doell authored 1 month ago

someone take the board away from me
Marwan authored 1 month ago

buddyOS buddy allocator for the buddyOS featuring the buddy
kevinzhang3 authored 1 month ago

goodnight
kevinzhang3 authored 1 month ago

Made fork called fork not dofork
kan728 authored 1 week ago

fixed a bug i swear im not commit farming i swear
Diego Cabrera Pell authored 1 week ago

let the debugging begin
Marwan authored 2 weeks ago a

UART PRINT WORKS MAN IM GONNA CRY THANK YOU AARON
Marwan authored Feb 23, 2025

ts works on hw
kevinzhang3 authored 3 weeks ago

i hate all of you and this stupid architecture
Alexei Doell authored 2 weeks ago and Aaron DSouz