

MatteOS

Matěj Bucek

Supervisor: prof. Ing. Tomáš Vojnar, Ph.D. Brno University of Technology

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Introduction

Developing an **operating system** is a complex task, requiring a deep understanding of **the CPU architecture**, **memory management**, **process scheduling**, and **hardware inter-action**. Existing OSs like Linux are powerful but also highly complex, making them difficult to grasp as a whole.

MatteOS is a lightweight, modular operating system designed for **RISC-V**, offering a clean and more educational approach. It bridges the gap between overly simplistic OS tutorials and full-fledged kernels, providing a foundation for **learning**, **experimenting**, and **exploring** modern **RISC-V** features.

The Architecture





- C++ Core OS development with object-oriented principles
- RISC-V Assembly Low-level routines and system calls
- QEMU Emulator for debugging and testing
- U-Boot Bootloader for initializing the system
- OpenSBI Platform specific abstraction
- Flattened Device Tree (FDT) Hardware description abstraction
- VirtIO Virtualized I/O for device interactions

Achievements

- System Boot The system boots up using a multi-stage boot process.
- Subsystems Implemented All the subsystems from the diagram of MatteOS architecture were implemented.
- **Processes scheduled** Processes (threads) are scheduled using the Round Robin algorithm.

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Hello from dummy process!				
Opened file successfully				
stats				
{"cpus": [{"id": 0, "time": 71976687}]}				
excel				
Hi, Excel@FIT!				
Process 1 is alive!				





Figure 1.

The Boot Flow

Figure 4.

Future goals

ELF Loader

- System Library available in Userspace
- Complete FAT32 implementation
- Extend VirtIO support
- Own **IDL** for code generation
- Implement drivers needed for boot on MPi-MQ1PL

Get in touch

Find more about MatteOS at https://matteos.mbucek.cz or use the QR code below:



References

[1] Anup Patel. OpenSBI Deep Dive. 2019. URL: https://riscv.org/wp-content/ uploads/2024/12/13.30-RISCV_OpenSBI_Deep_Dive_v5.pdf.



Runs from On-Chip

Uses On-Chip SRAM
Power-up, clock setup and FDT in a1

ROM

(QEMU)

MatteOS uses U-Boot and OpenSBI in a multi-stage bootloader setting.

The DeviceTree

Figure 2. [1]

Runs from DDR

• SEE



Figure 3.



MatteOS

(S-mode)