Project Report: Milestone 3 Integration

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1. **Introduction**

- **Submitted by**: Amr Hossam
- **GitHub Repo**: GitHub Repo Link
- This milestone focused on the design, integration, and testing of an **AHB-Lite** system featuring a master module, RAM, ROM, decoder, and MUX. The goal was to establish a working AHB-Lite bus system capable of interfacing with RAM and ROM efficiently using address-based decoding and data routing.

2. **System Overview**

- The **AHB_TOP module** serves as the central integration block for all system components: the master, decoder, MUX, RAM, and ROM.
- **Operation**: The system executes read/write operations, directing transactions to RAM or ROM based on address decoding.
- **MUX**: Facilitates dynamic routing of data and response signals between RAM/ROM and the master, depending on the selected memory.

Block Diagram

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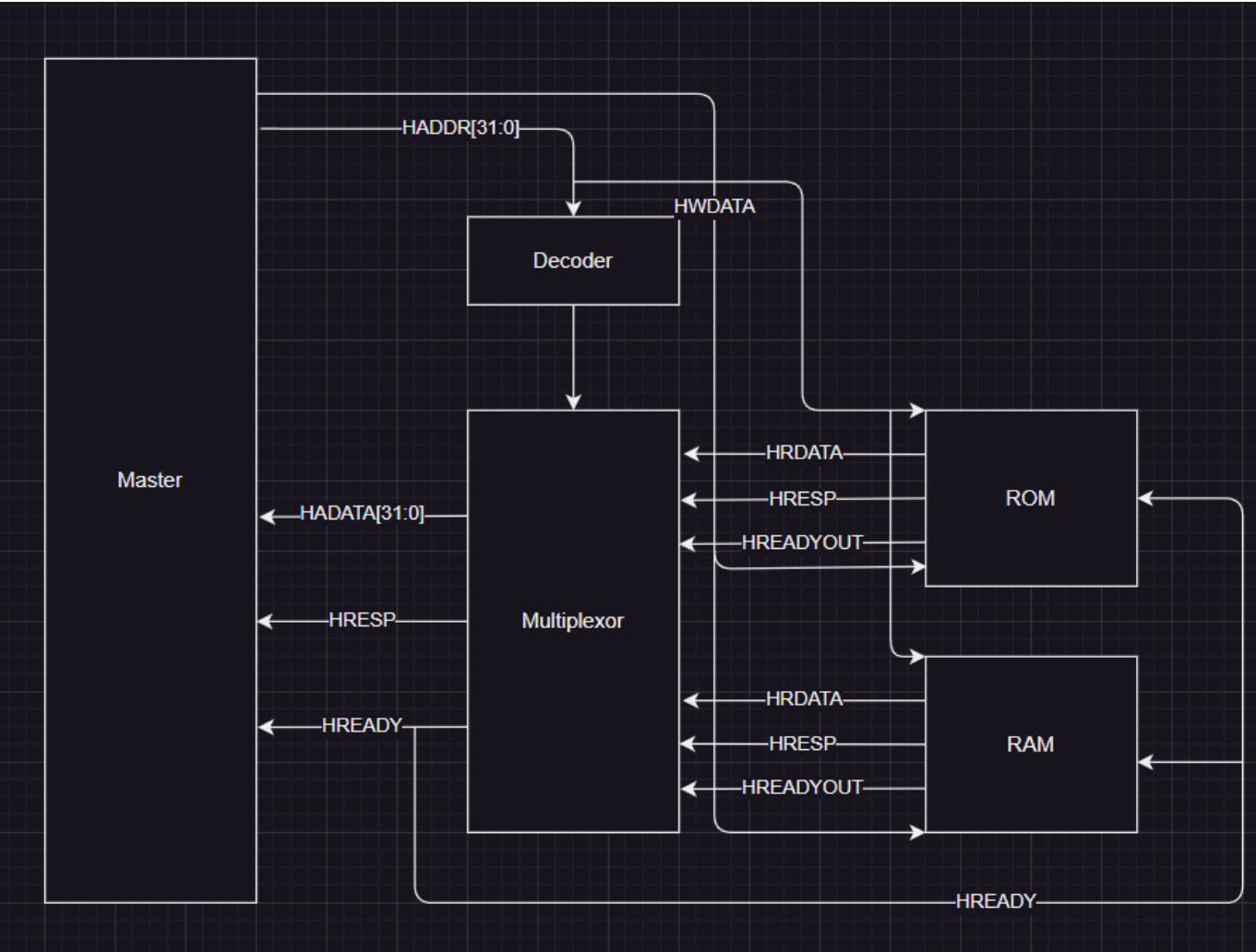
3. **Integration and Testing**

- **Decoder**: Manages address decoding, ensuring that the correct memory block (RAM/ROM) is selected based on the higher-order address bits.
- **MUX**: Routes the appropriate data and control signals (HREADY, HRESP) to the master, depending on the selected memory.
- **Master**: Drives read and write transactions through AHB-Lite compliant signals, handling the interactions with the memory blocks.

Testing Methodology:

- **Testbench**: Testbench was created to validate the master's ability to interface with RAM and ROM through the AHB-Lite bus.
- **Waveform Analysis**: Used to visually verify data transfers, memory selections, and signal transitions.

Waveform Capture

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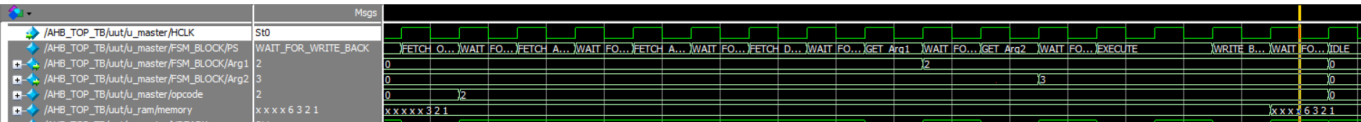
4. **What I Learned and Improvements**

- **Design Flow**: Initially, my design approach wasn't ideal. Moving forward, I would focus on planning the entire design before starting implementation to avoid issues in later stages.

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5. **Unsupported Features**

- Multilayer AHB-Lite
- Protection (HPROT)
- Master lock (HMASTLOCK)
- WRAP4, INCR4, WRAP8, INCR8 support for HBURST

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6. **Conclusion**

- **Milestone Achieved**: The project successfully integrates RAM and ROM into a functional AHB-Lite system, with complete verification through waveform analysis.