

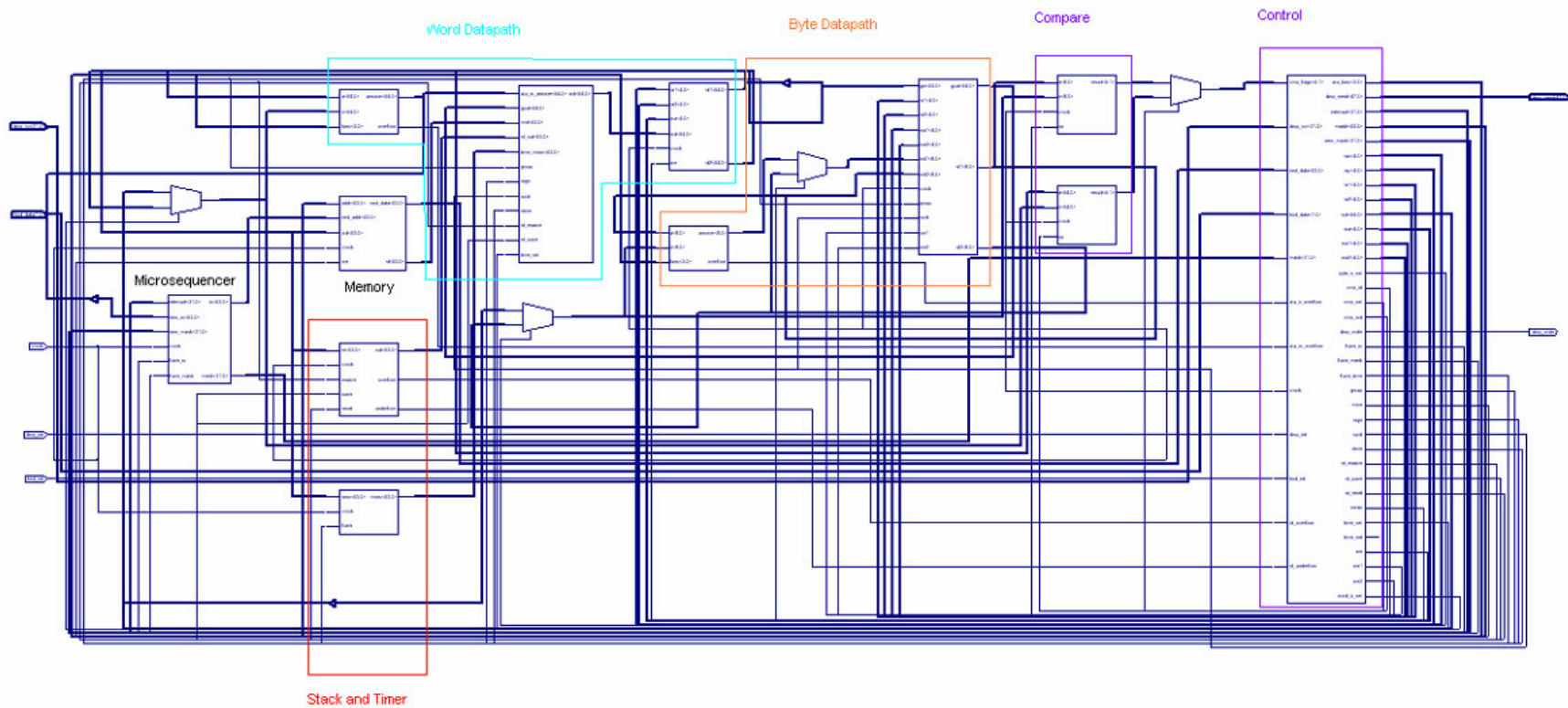
System on a Chip

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Overview

- General purpose computer
- 64-bit RISC processor
- Memory: 256KiB RAM
- Peripherals: keyboard and monitor

CPU Block Diagram



Microsequencer

- Increments an instruction counter normally
- Changes value for branches and interrupts
- 32 interrupts, all maskable (mask can also be altered by operations)

Memory

- 256 KiB (32K x 64) dual-port Block RAM
- One port is read-only, for instruction fetch
- The other port is R/W, for data storage
- Load/store data storage interface

Split Datapaths

- Two similar datapaths of different widths: word (64-bit) and byte (8-bit)
- Nearly identical in structure and operation
- Special operation pair (SPLIT/JOIN) for interpath communication

Register File

Word

- 32 registers (register 31 always reads 0)
- Internal sign maintenance (65th bit)
- Ports: 2 read, 1 write

Byte

- 32 registers (register 31 always reads 0)
- Internal sign maintenance (9th bit)
- Ports: 2 read, 2 write + 8 special R/W

ALU

Operations supported (both word and byte):

- Add, subtract, multiply (maybe divide/mod)
- Shift (arithmetic or logical) and rotate
- Bitwise and, or, xor, nand, nor, xnor
- Two register operands or one and a literal

Special Modules

Stack

- Word-width stack implementation
- Interface through synchronous PUSH and POP operations

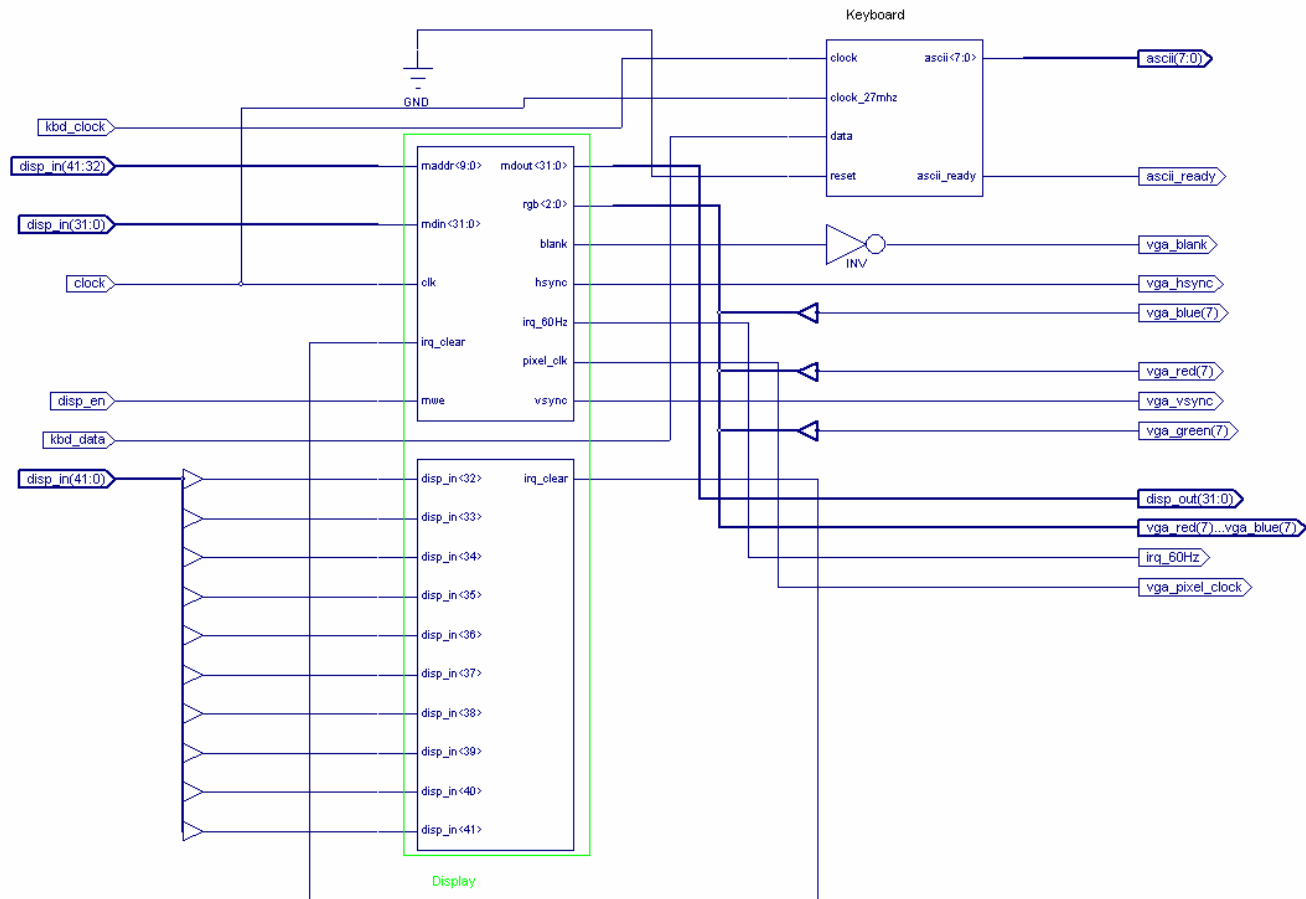
Timer

- Settable word-width millisecond counter
- Interface through synchronous set and get time operations

Control Logic

- Implements every operation by setting the control signals to appropriate values
- Has subordinate compare modules (word and byte) with compare flags
- Operations include: (un)cond. branches, I/O operations, byte swap, interrupt call

I/O Block Diagram



Input/Output

- Abstracts away peripheral operations
- Port-mapped I/O

Devices:

- PS/2 keyboard (converted to ASCII)
- 640x480 VGA text-mode display

Demonstration

Programs (in order of complexity):

- Echo keyboard input to display
- Generate and display text (i.e. the time)
- Manipulate keyboard input
- Keep information in memory over multiple application runs
- Text-based games
- Miniature file system and OS