EEC 180

Memories

May 20, 2021

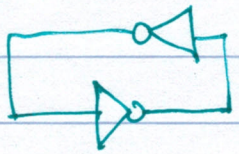
View 2

1) Read-Write Memories

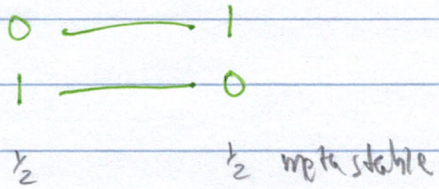
A) Static Rand. Access Mem. (SRAM)

cell - bistable element

back-to-back inverters

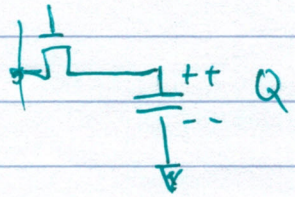


holds value until power is removed



B) Dynamic RAM - (DRAM)

- holds value for only a very short time ~ <1msec
- requires refreshing



2) ROM - Read-Only memories

- Non-volatile

A) Basic ROM - values cast when chip is fabricated

B) Programmable ROM - PROM

- fuse
- anti-fuse

C) Synthesized from std cells - ASIC

CLBs - FPGA

3) Non-Volatile Rd/Wr Mems - NVRWM

A) EPROM - Erasable Prog. ROM

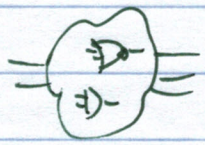
erasable w/ UV light

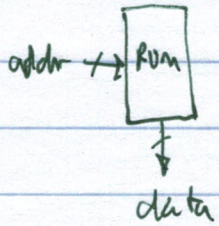
B) EEPROM - Elect. Eras. Prog ROM - (Flash)

- erase electrically

View 3

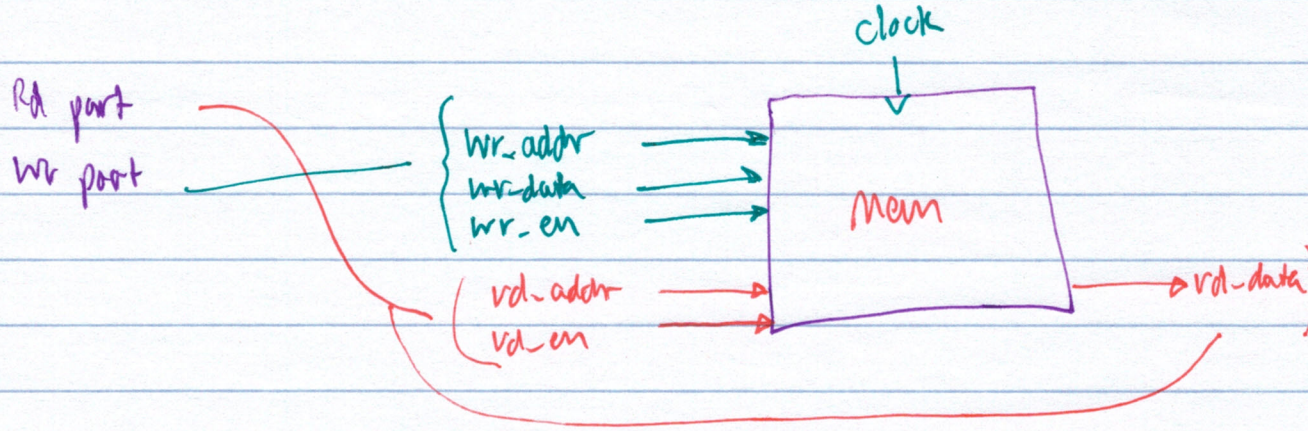
1) Combinational (output depends on only present inputs)
   - ROM





2) Feels Combinational but technically Sequential
   - PROM
   - EPROM

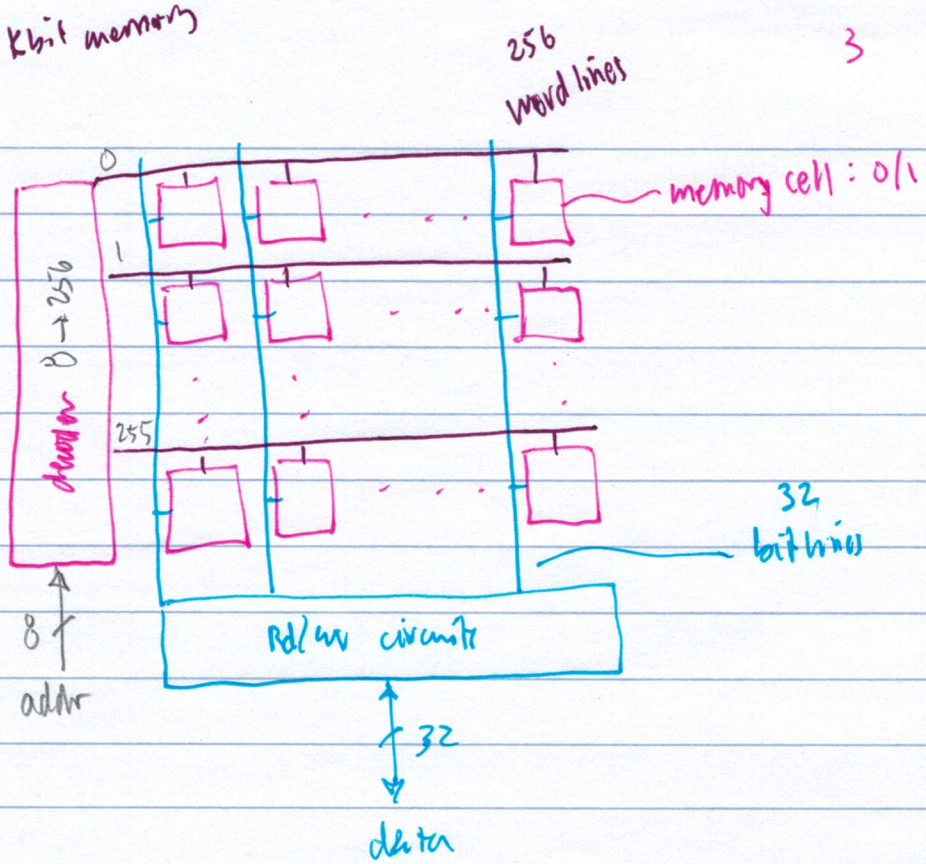
3) Sequential (output depends on present + past inputs)
   - SRAM
   - DRAM
   - Flash



rd_en for power reduction

8 Kbit memory

Components
- array of cells
- addr decoder
- Wr circuitry
- Rd circuitry
- word lines
- bit lines

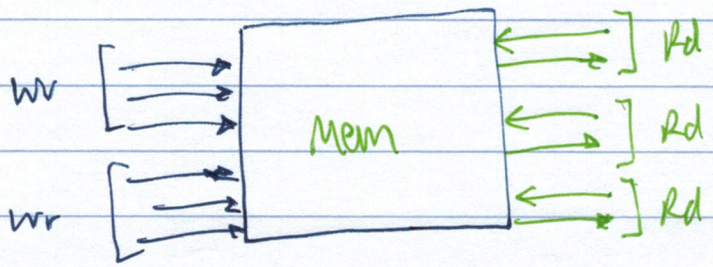


Interfaces
- Addr
- Data
- En_wr
- En_rd
- clock

Multi-ported SRAM

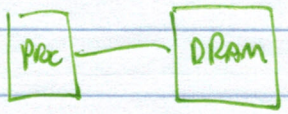
Ex: register file for classic RISC - 1 Wr + 2 Rds per cycle

Ex. Itanium 22 ports (12 Rd + 10 Wr) [USIC 2005]

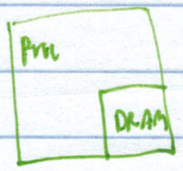


DRAM

- Classic DRAM
- Embedded DRAM



expandable



View 4 - Memory types for custom chips

1) On-chip "macro" memory arrays
2) On-chip synthesized from verilog
3) Off-chip

1) A) On-chip Macro Mems

Software Tool to generate macro. We choose:

- # of words 256
- word width in bits 32
- # of rd ports
- # of wr ports
- rd/wr or ROM
- BIST - built-in self test

=

Output:

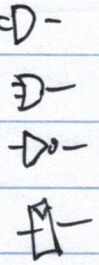
- Verilog
- other CAD views

B) FPGA

"Block RAMs"

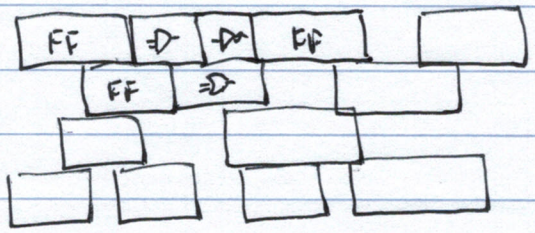
- Altera M9K - 8K or 9K bits each

182 on chip

2) Verilog synth into std cells - 

A) ASIC std cell

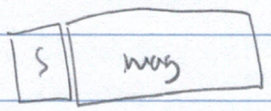
meaning cells built w/ FFs



B) FPGA

Build w/ CLB elements

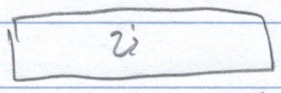
Our chip has 50,000



0 pos

0 zero

1 neg



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