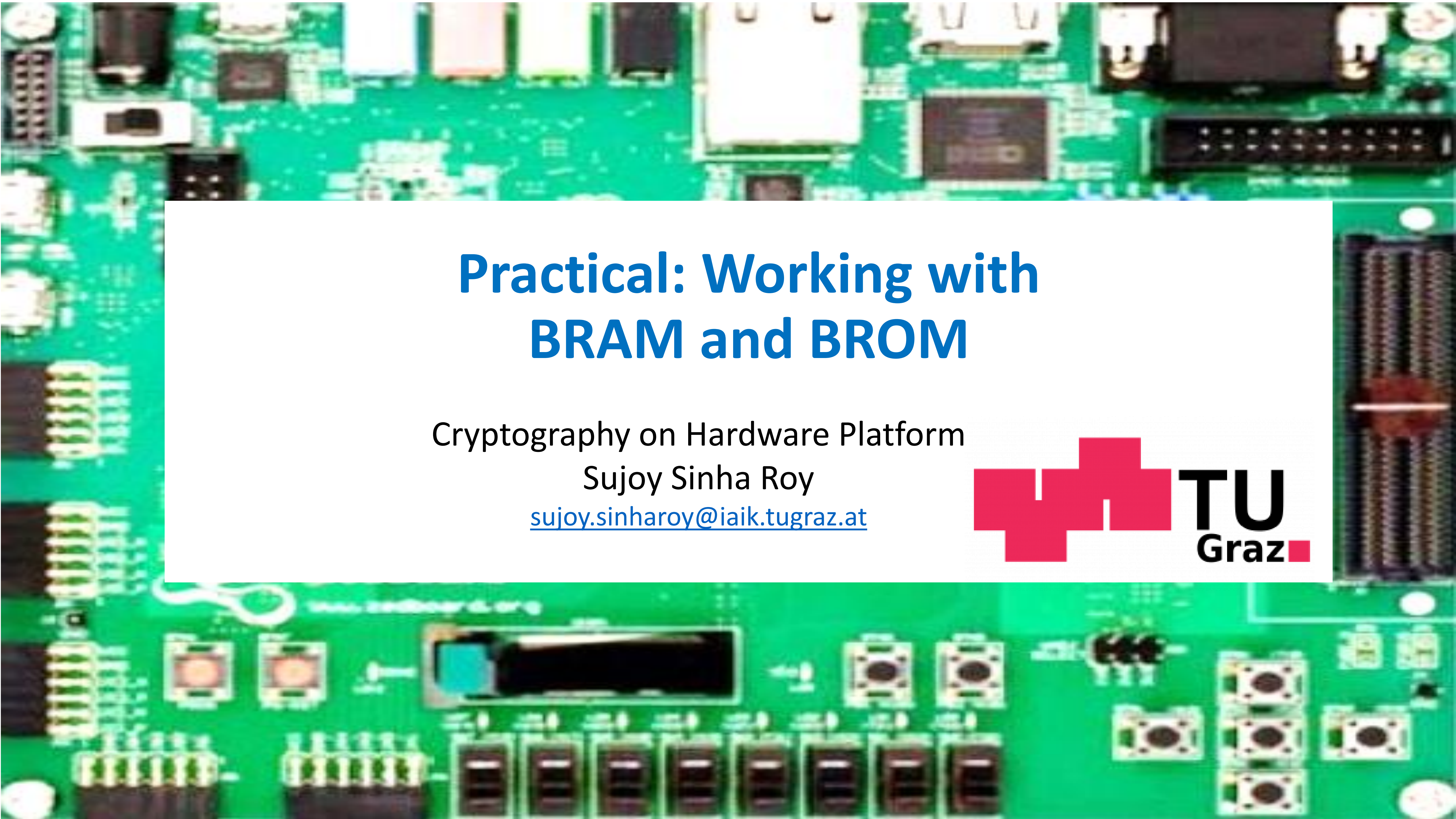

Practical: Working with BRAM and BROM

Cryptography on Hardware Platform

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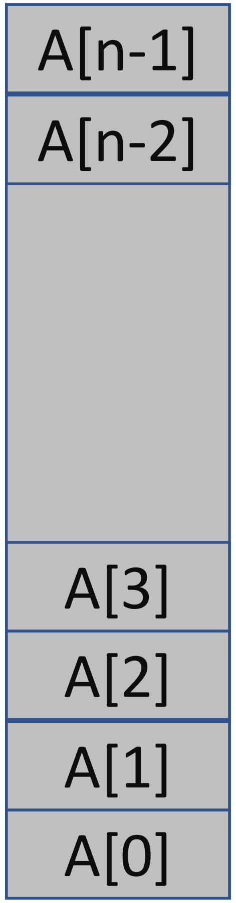
Block Random Access Memory (BRAM)

BRAM is an addressable memory element (IP) with at most two ports.



A[n-1]

A[n-2]

A[3]

A[2]

A[1]

A[0]

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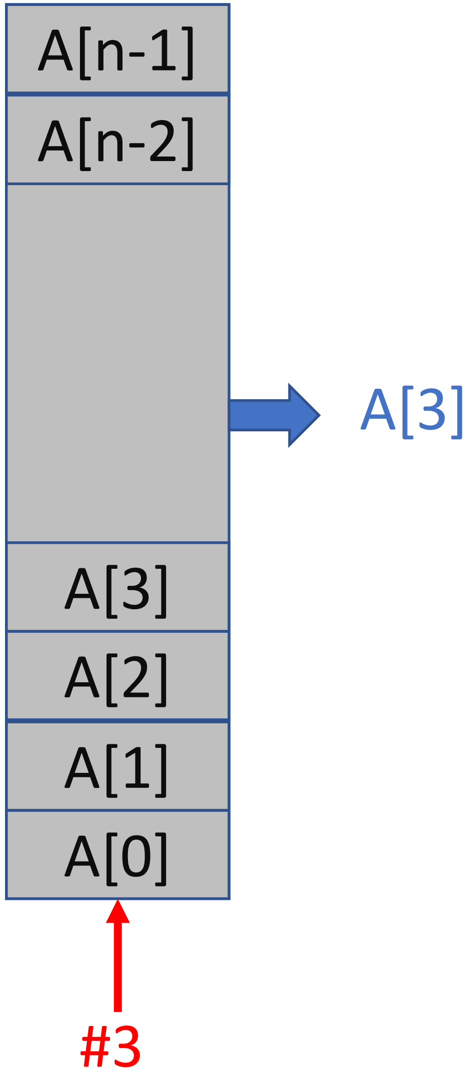

1. To read a cell, we provide the address of the cell to the address port of the BRAM IP.

2. The data from the cell is obtained at the read port

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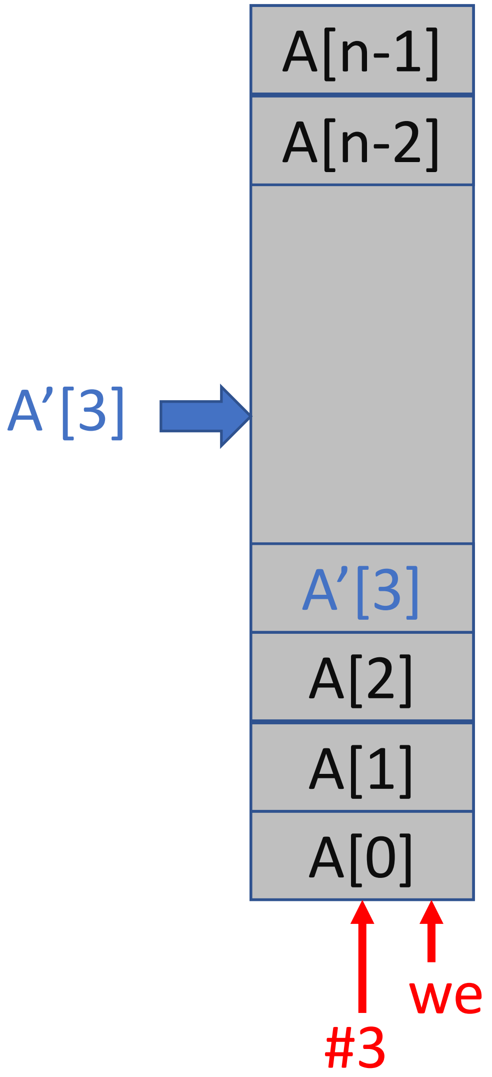


1. To write to a cell, we provide the address of the cell.

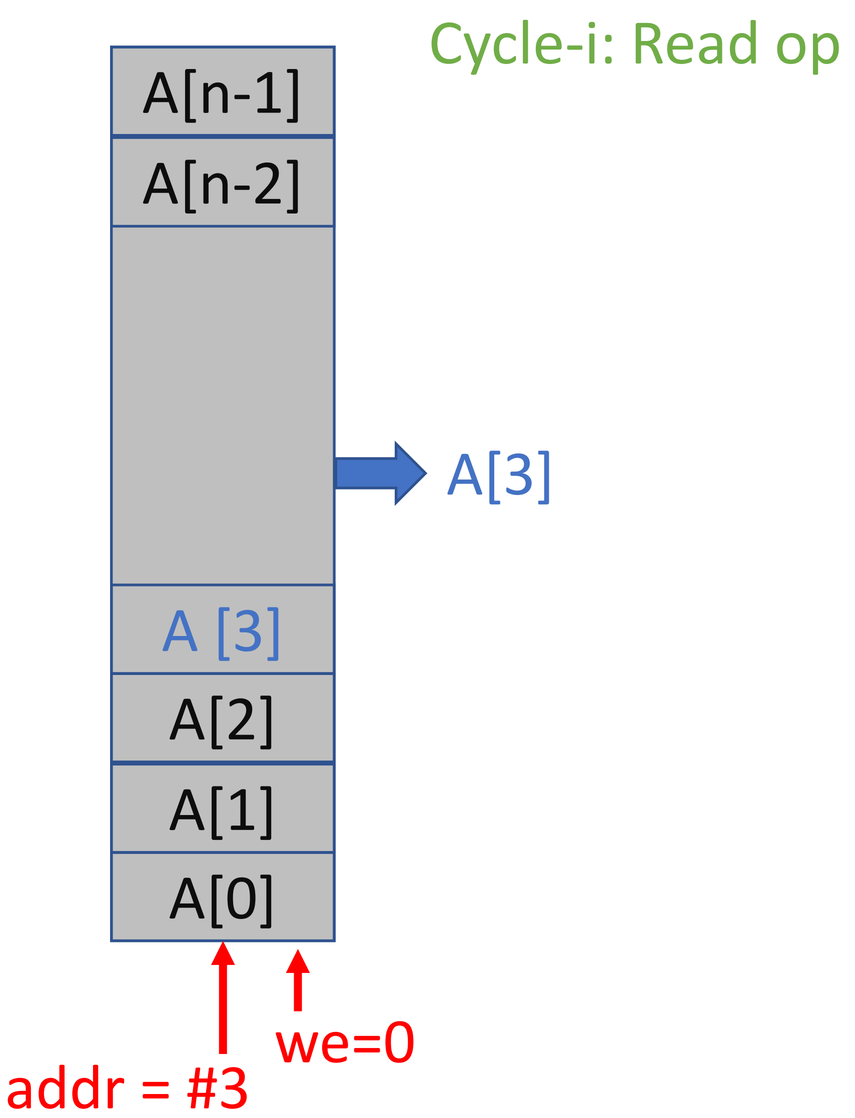
2. We also provide the write-enable signal.

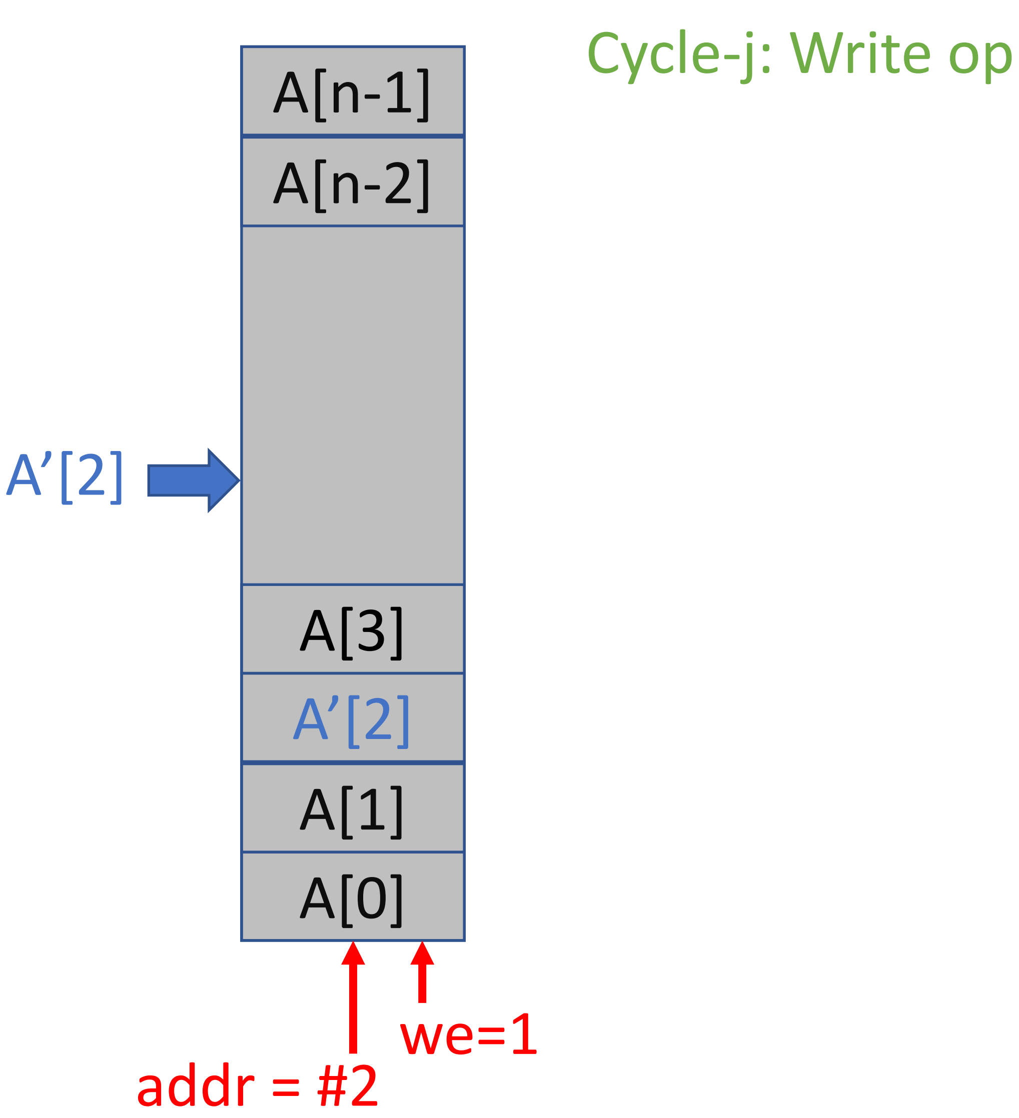
3. We provide the data value.

4. In the next cycle, the data value gets written into the memory cell.

BRAM configurations: Single Port

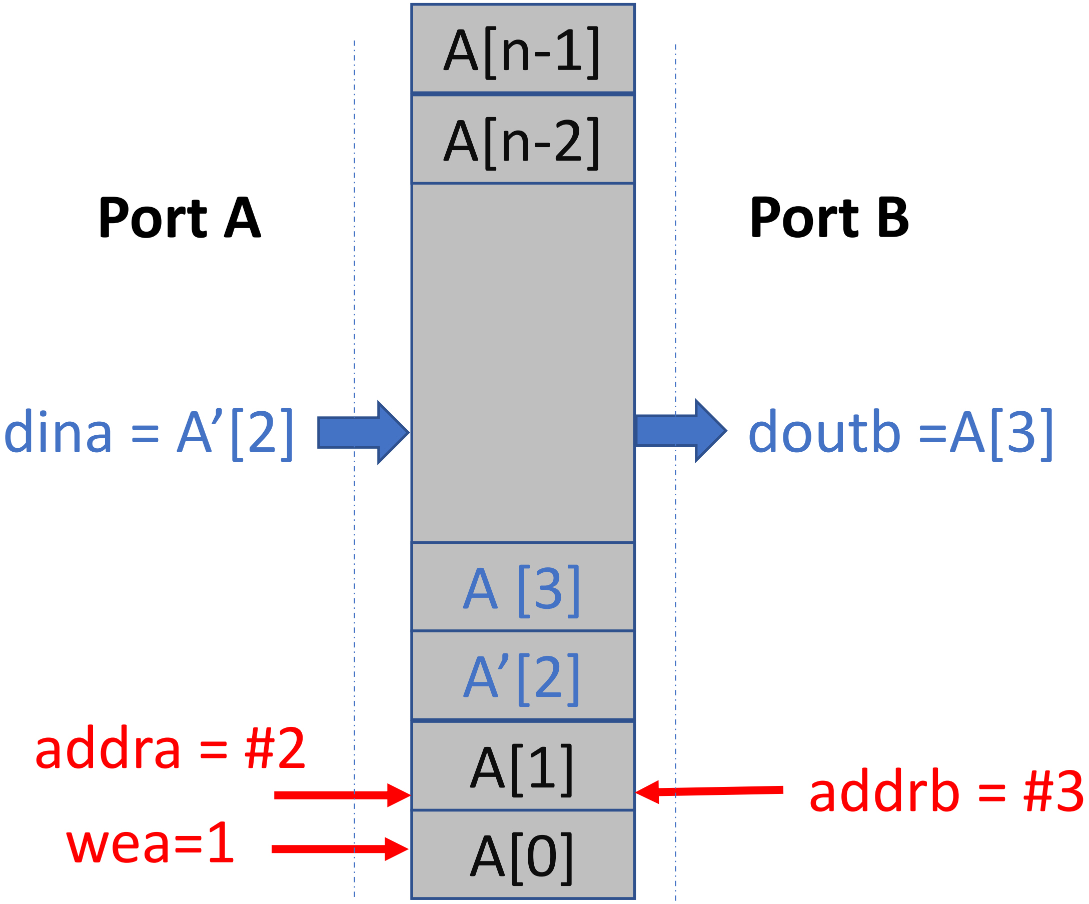
Single port BRAM has only one port. At any cycle, you can do either read or write.





BRAM configurations: Simple dual Port

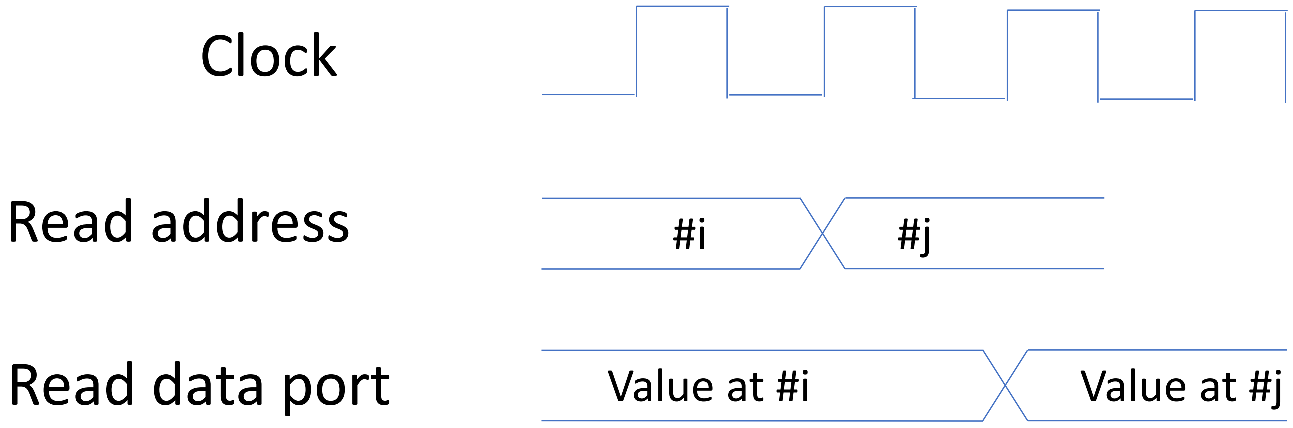
There are 2 ports. Port-A is used for only Write. Port-B used for only Read.



Cycle-i:
Read address 3 and
Write address 2 in parallel.

At most 1 read and 1 write per cycle.

BRAM READ has a latency of 1 cycle.



Clock

Read address

#i

#j

Read data port

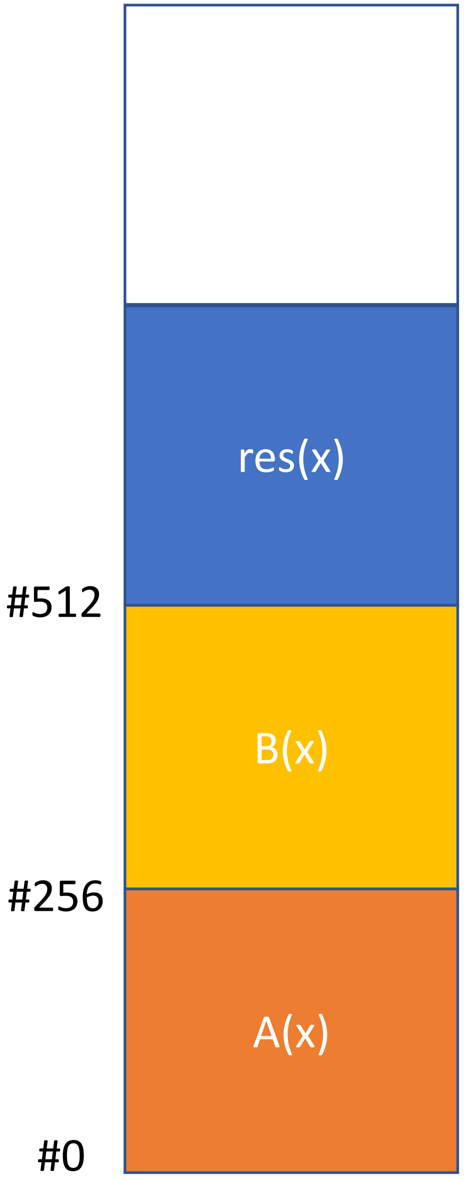
Value at #i

Value at #j

Working with Simple dual Port BRAM

Watch demo video.

Hands on: Coefficient-wise polynomial multiplication



Simple dual port BRAM64x1024

Question: Two polynomials A(x) and B(x) of 256 coefficients are stored in the BRAM.

Compute there coefficient-wise multiplication and store the result starting from address #512 in the BRAM.

```
For(i=0; i<256; i++)
        res[i] = A[i]*B[i] % q
```

If I have 24 hours and I have to design an architecture ….

My steps for digital design:

1. Spend 4 hours on understanding the algorithm very well.

2. Spend 4 hours thinking various design approaches, their merits/demerits, ease of implementation, ...

3. Spend 4 hours on drawing block architecture diagram

4. Spend remaining 12 hours on coding, testing, and debugging …

Diagram for Coefficient-wise polynomial multiplication

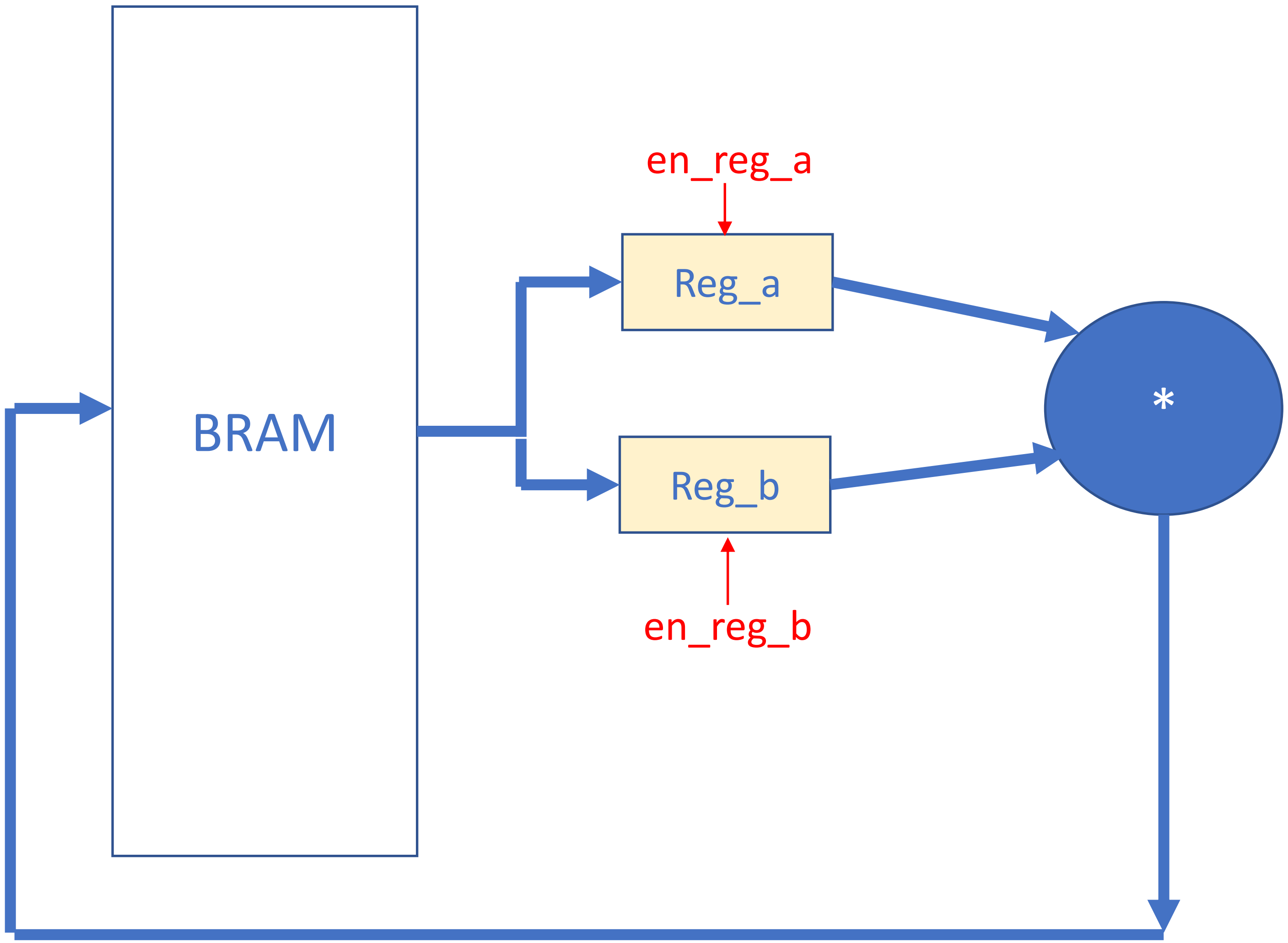
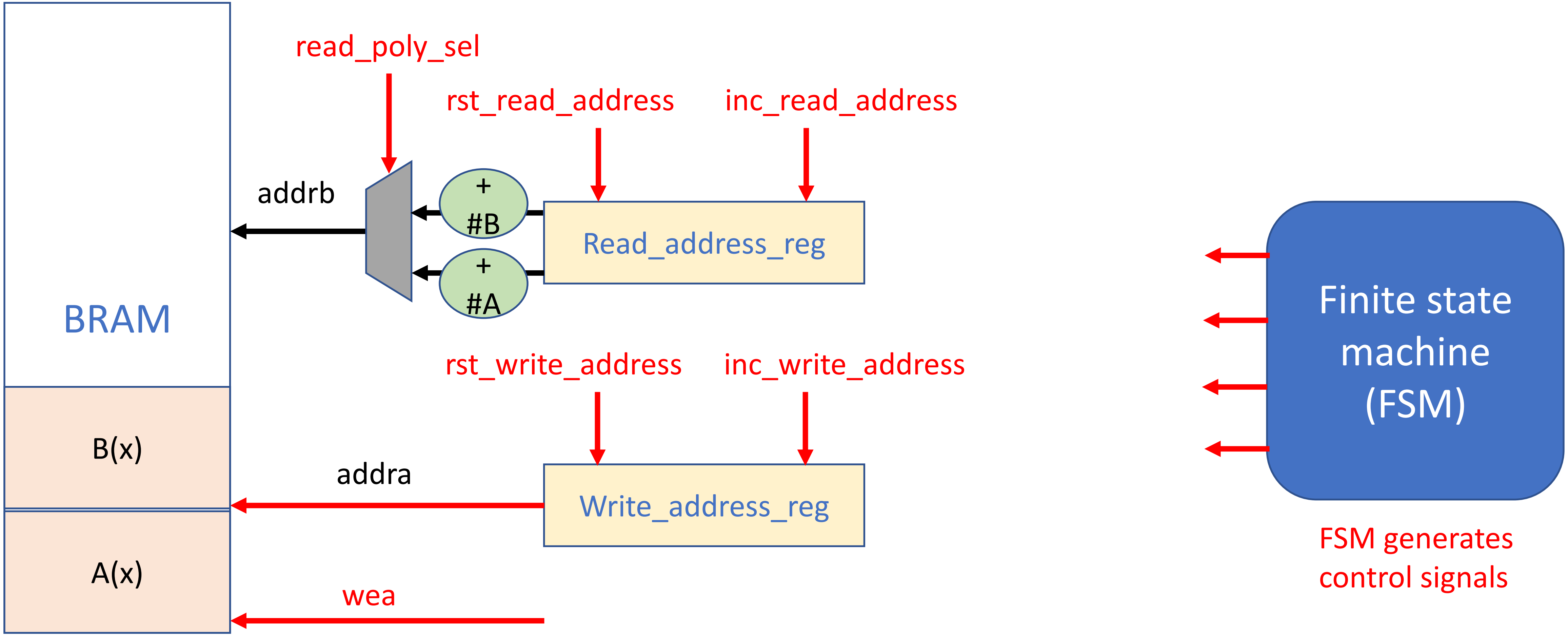


Diagram for Coefficient-wise polynomial multiplication

Generating control signals for the BRAM



FSM generates control signals