

Report on 1-D Time-Domain Convolution

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Implementation:

The project was implemented successfully as tested by the provided C++ code in the board.

DRAM_RD implementation:

The block diagram and important signals of our dram_rd IP are shown below:

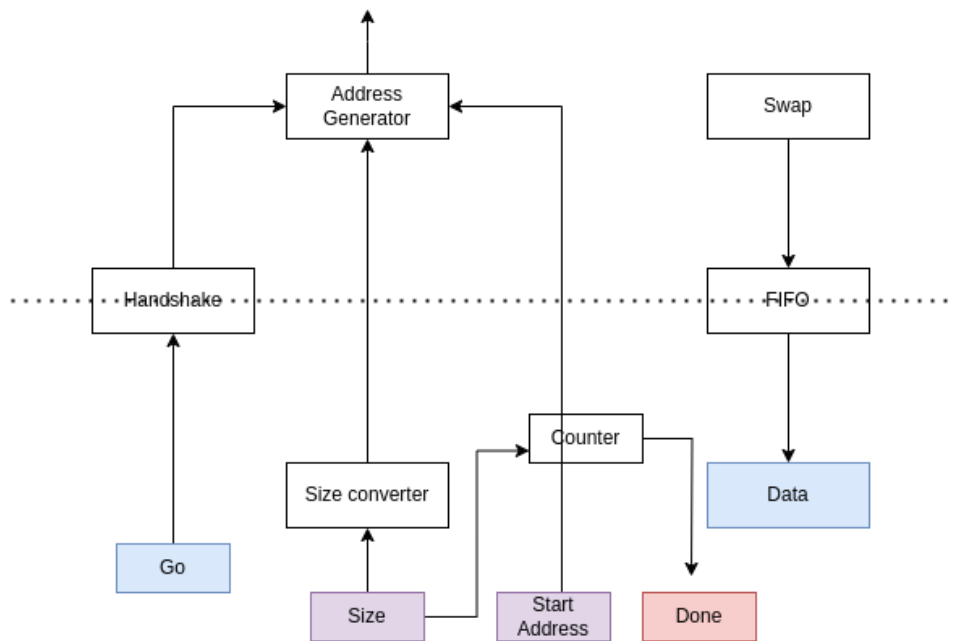


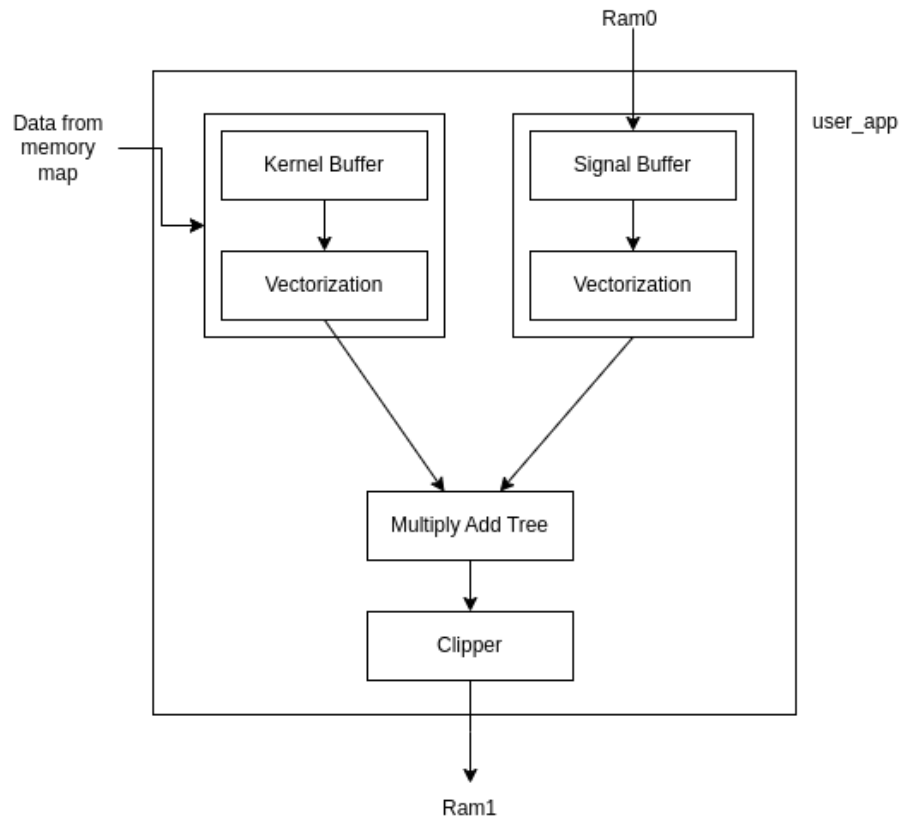
Fig. 1: Block diagram of dram_rd.

Design considerations:

1. Address generator generates address of specified size from a starting address.
2. We designed the address generator using 2 process which made sure the address generator has no latency in producing addresses.
3. A counter generates the done signal which counts the number of times the fifo has been read
4. Input to Fifo was needed to be swapped between upper and lower 16 bits.

Convolve implementation:

The block diagram of our convolve IP is given below:



Design considerations:

1. No FSM were required for control.
2. Ram_1_wr_ready was used as the enable signal of the user app.
3. 2 separate entities for kernel and signal buffer was designed. Vectorization was done inside the buffers.
4. Ram_1_wr_done as the done signal for the user_app

Results:

Dram test:

```
monjil.m@ece-b312-recon2:~/x2
[monjil.m@ece-b312-recon2 x2]$ zed_schedule.py ./zed_app design_1_wrapper.bit
Searching for available board....
Starting job "./zed_app design_1_wrapper.bit" on board 192.168.1.170:
Programming FPGA....SUCCESS
Testing transfers to/from address 0....SUCCESS
Testing max transfer size....SUCCESS
Testing random sizes and addresses....SUCCESS
[monjil.m@ece-b312-recon2 x2]$
```

Convolve:

```
monjil.m@ece-b312-recon2:~/x
[monjil.m@ece-b312-recon2 x]$ zed_schedule.py ./zed_app convolve.bit
Searching for available board....
Starting job "./zed_app convolve.bit" on board 192.168.1.173:
Programming FPGA....Testing small signal/kernel with all 0s...
Percent correct = 100
Speedup = 0.0197044

Testing small signal/kernel with all 1s...
Percent correct = 100
Speedup = 0.0120482

Testing small signal/kernel with random values (no clipping)...
Percent correct = 100
Speedup = 0.0162162

Testing medium signal/kernel with random values (no clipping)...
Percent correct = 100
Speedup = 2.77531

Testing big signal/kernel with random values (no clipping)...
Percent correct = 100
Speedup = 15.6609

Testing small signal/kernel with random values...
Percent correct = 100
Speedup = 0.0176471

Testing medium signal/kernel with random values...
Percent correct = 100
Speedup = 2.85755

Testing big signal/kernel with random values...
Percent correct = 100
Speedup = 14.2537

TOTAL SCORE = 100 out of 100
[monjil.m@ece-b312-recon2 x]$
```