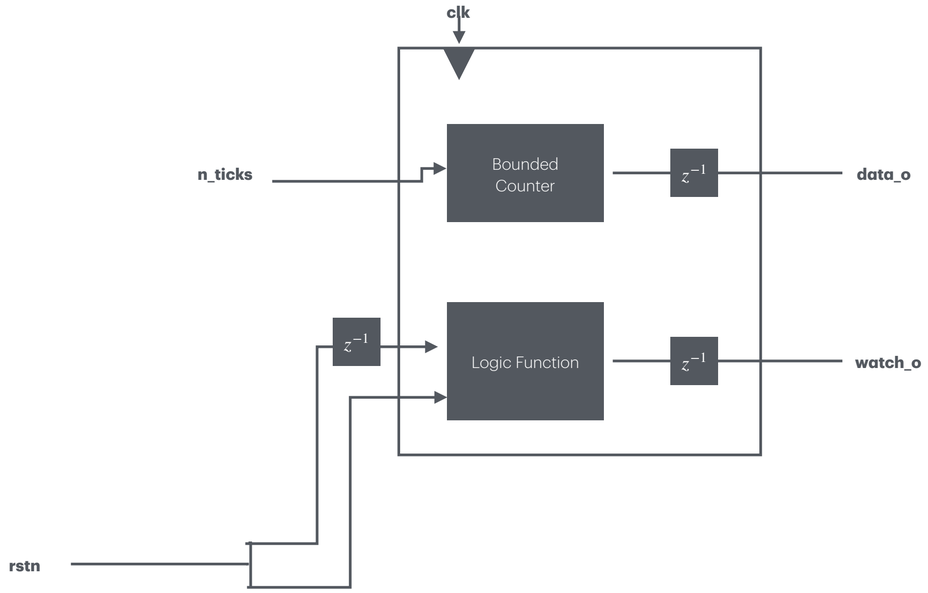
Sys-Verilog Questions Review

Some Solutions to questions from ChipIO-Dev

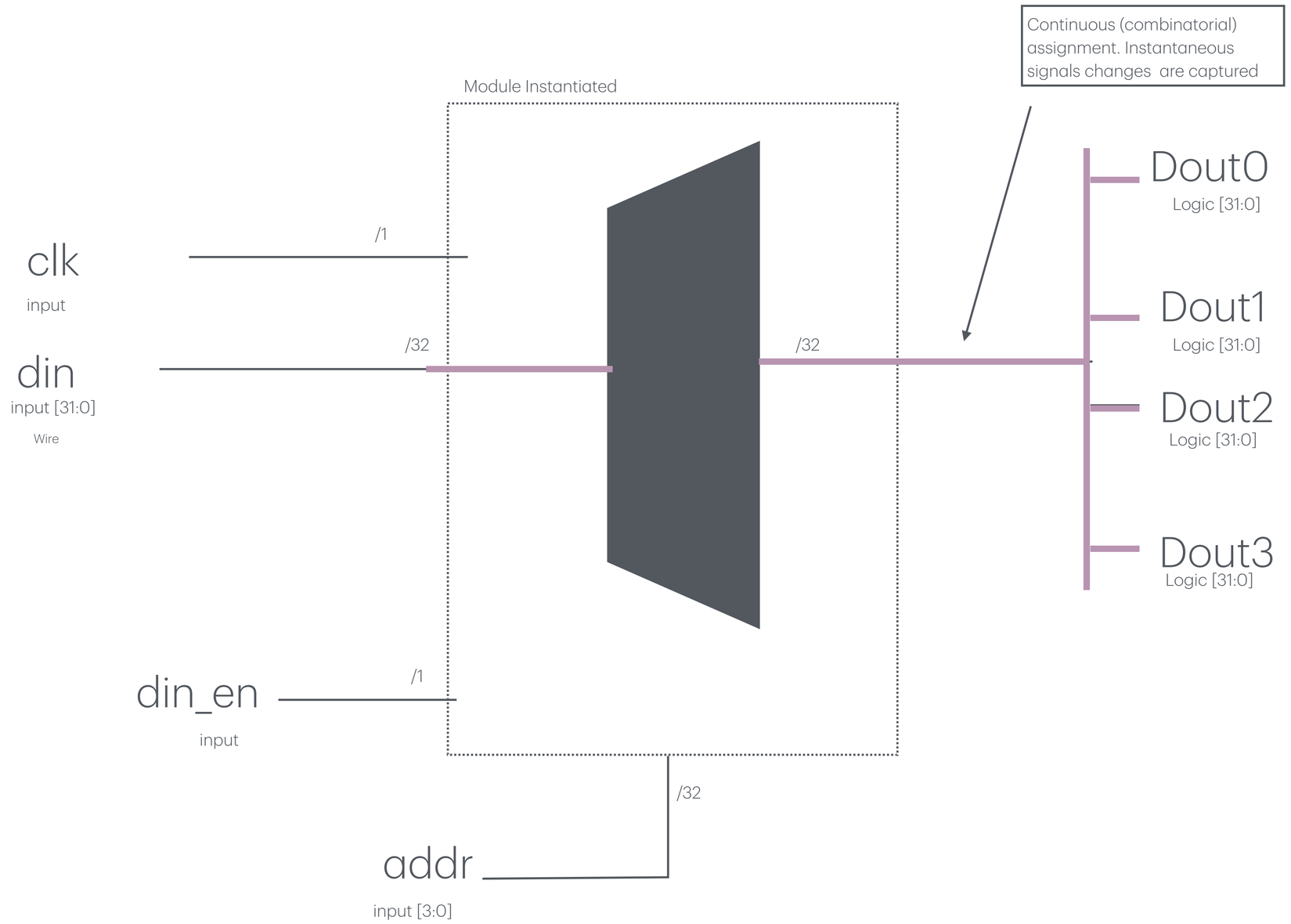
Hector “Hectron” Williams

Counter

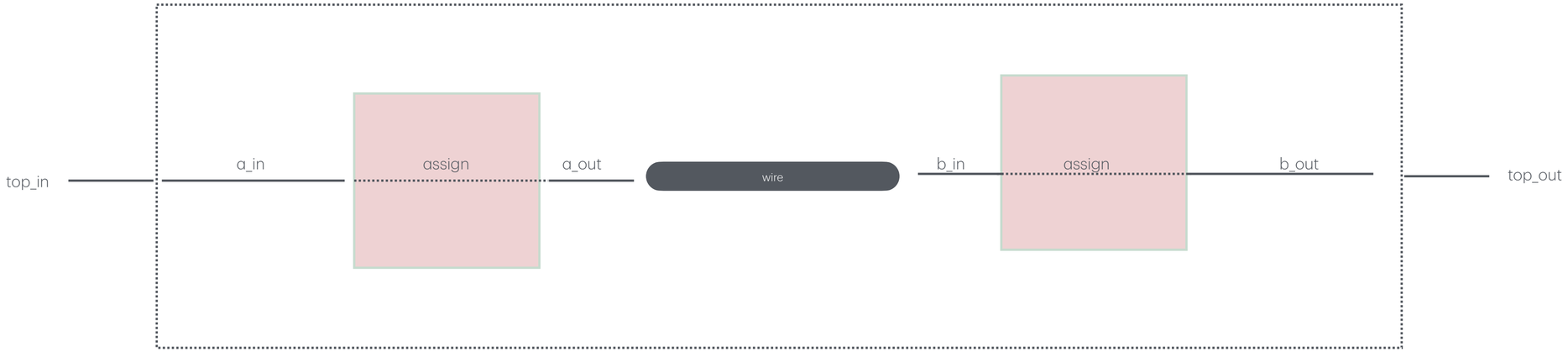
Counter


clk
n_ticks
Bounded Counter
z^{-1}
data_o
z^{-1}
Logic Function
z^{-1}
watch_o
rstn

Router

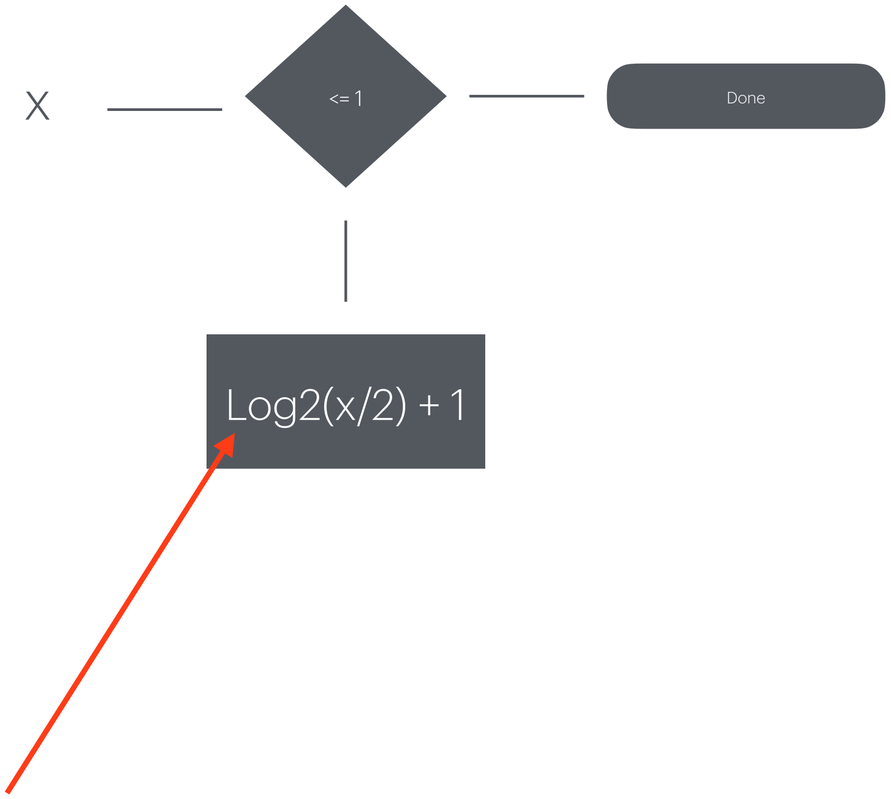

Continuous (combinatorial) assignment. Instantaneous signals changes are captured
Module Instantiated
clk
input
/1
din
input [31:0]
Wire
/32
/32
Dout0
Logic [31:0]
Dout1
Logic [31:0]
Dout2
Logic [31:0]
Dout3
Logic [31:0]
din_en
input
/1
/32
addr
input [3:0]

Connect (wire)



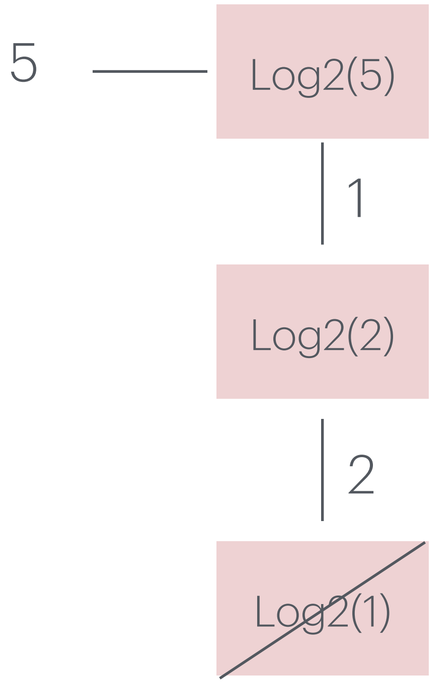
Log2

Log2



Recursion or calling the same hardware segment repeatedly

Log2(**5**)

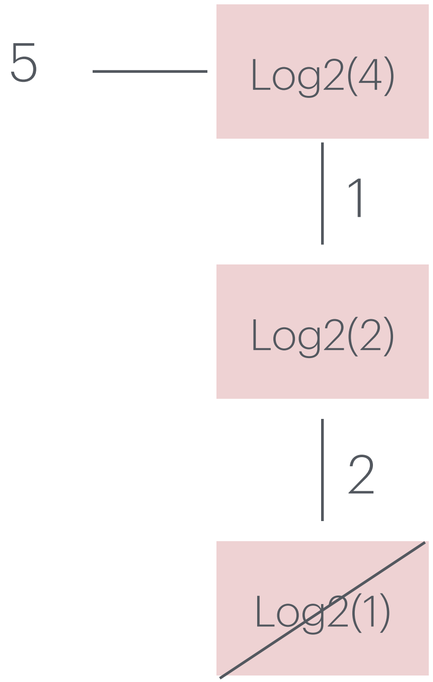


Minimum number of bits represent 5?

Min = 2

$5 > 2^2$ (increment)

Log2(**4**)



Minimum number of bits represent 5?

Min = 2

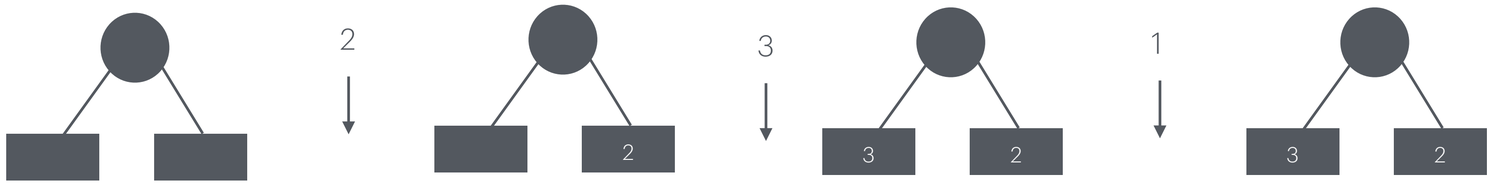
$4 \not< 2^2$ (perfect)

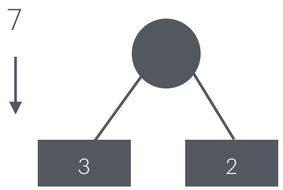
Log2 : Debug Results

VECTOR SENT [1] - [36]
VECTOR SENT [2] - [129]
VECTOR SENT [3] - [9]
VECTOR SENT [4] - [99]
VECTOR SENT [5] - [13]
VECTOR SENT [6] - [141]

VECTOR RCVD [6]
VECTOR RCVD [8]
VECTOR RCVD [4]
VECTOR RCVD [7]
VECTOR RCVD [4]
VECTOR RCVD [8]

Second Largest

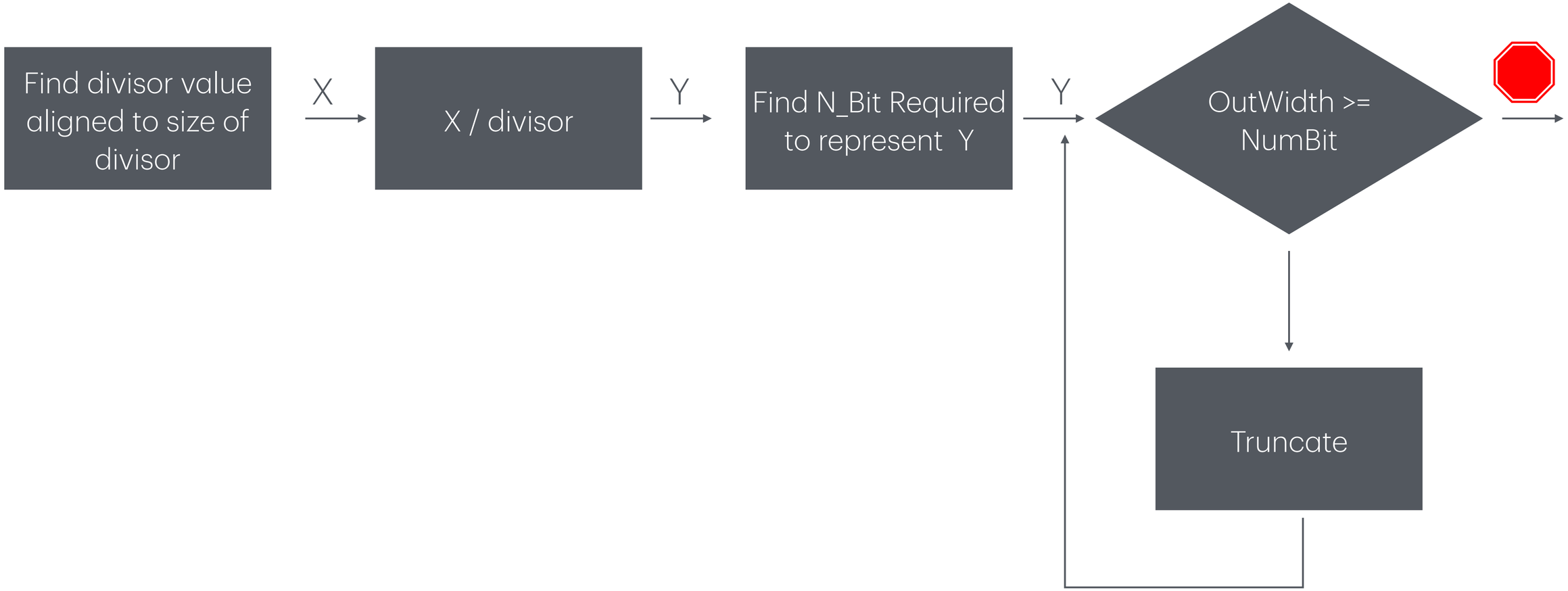




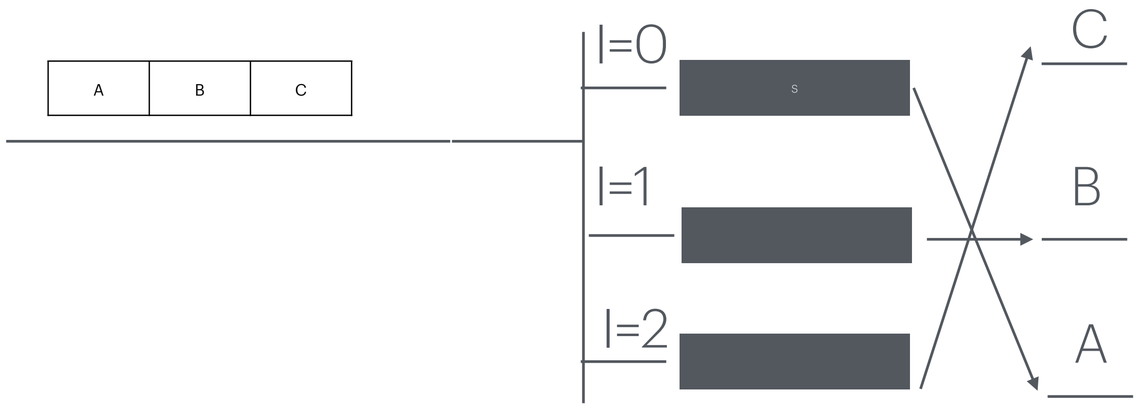
Count	0	1	2	3	4	
Data_In	D0	D1	D2	D3	D4	
2nd Largest	0	0	2	2	2	3

-, **2** 3, **2** 3, **2** 3, **2** 7, **3**

Rounded Division

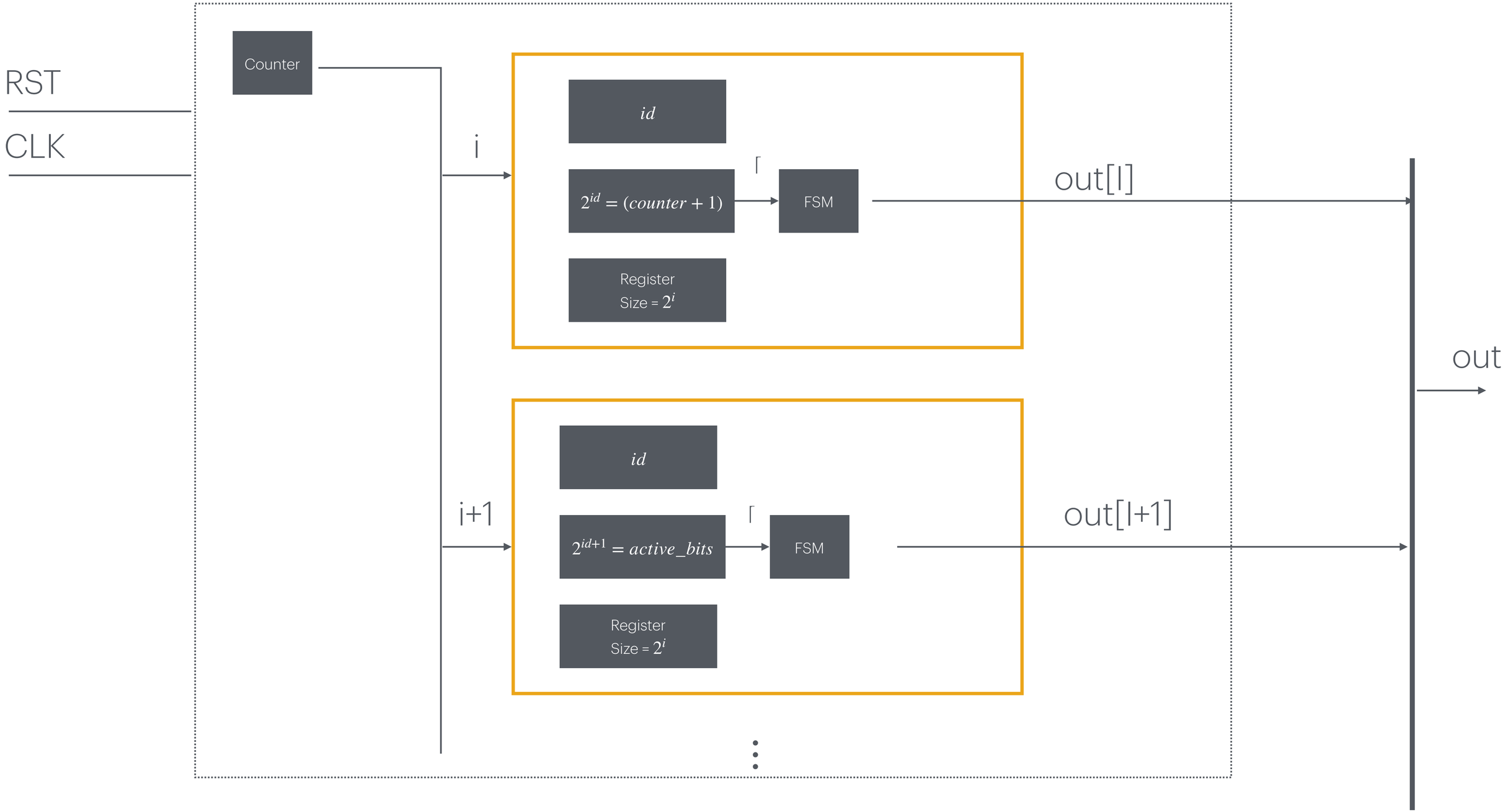


Reverse Bits



Generate Logic Blocks

Gray code


RST
CLK
Counter
i
id
$2^{id} = (counter + 1)$
⌈
FSM
Register
Size = 2^i
out[I]
out
i+1
id
$2^{id+1} = active\_bits$
⌈
FSM
Register
Size = 2^i
out[I+1]

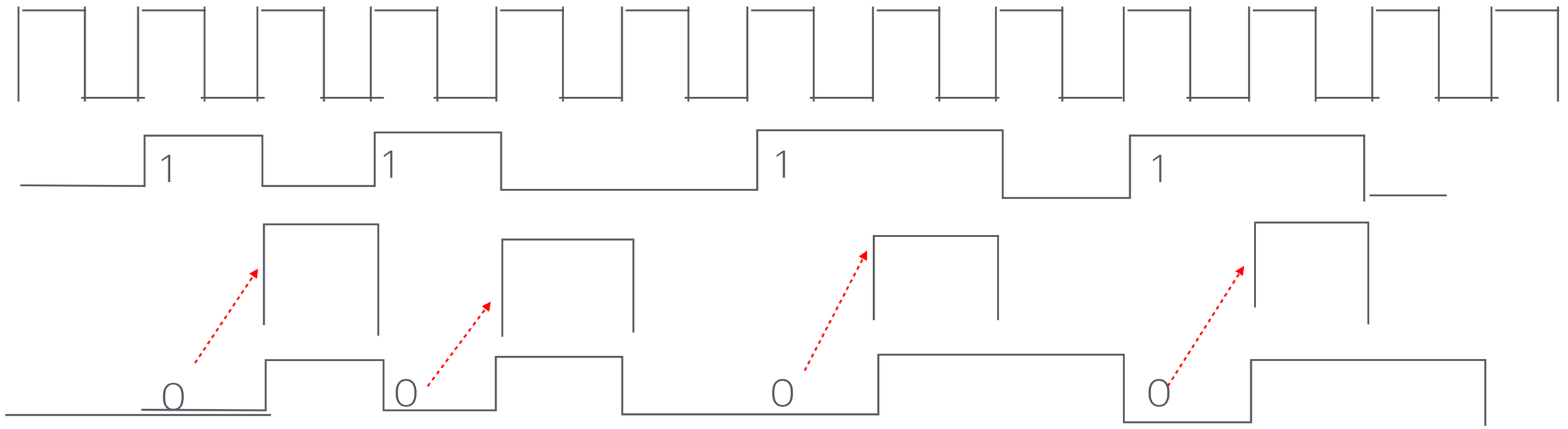
Gray code

Vertical Delay :)

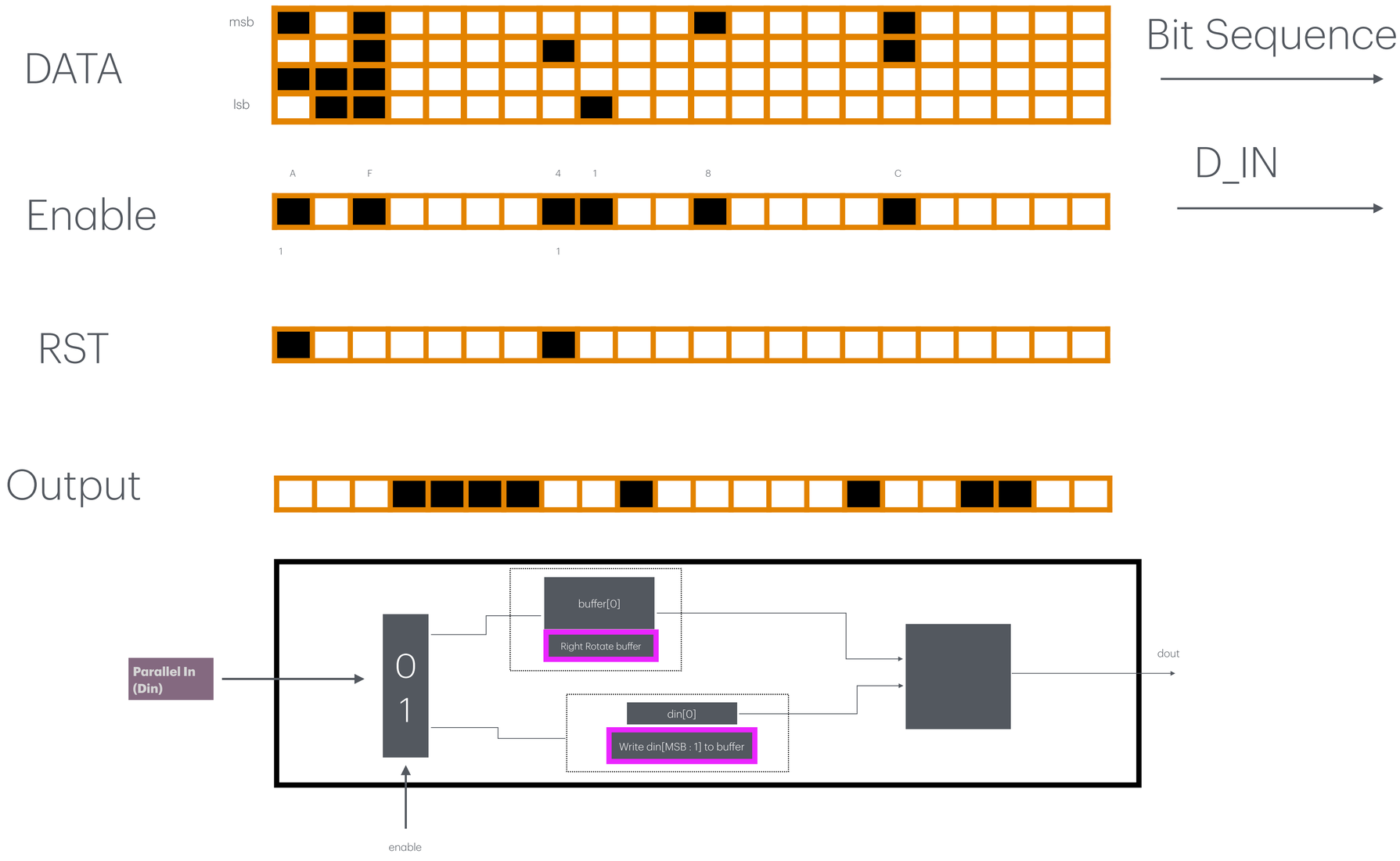
$2^3 = 8cycle$ $2^2 = 4cycle$ $2^1 = 2cycle$ $2^0 = 1cycle$

0	0	0	0
0	0	0	1
0	0	1	1
0	0	1	0
0	1	1	0

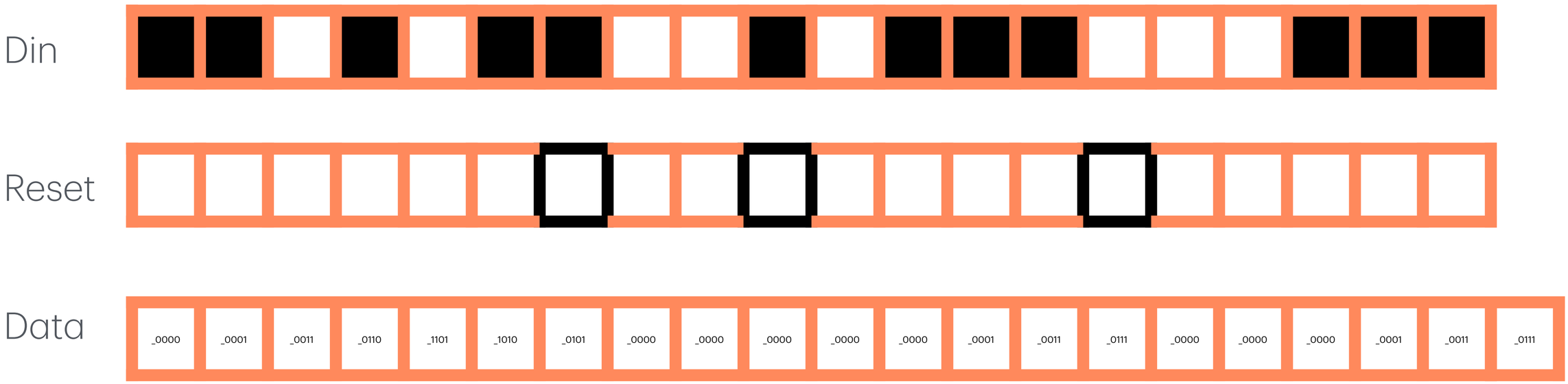
Egde Detector

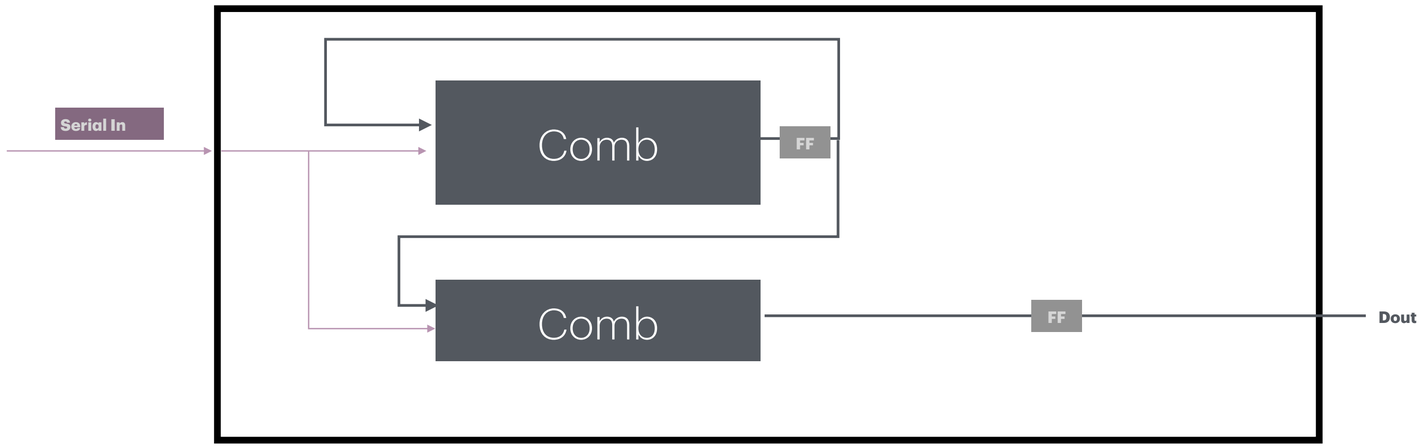


Parralel In -Serial Out

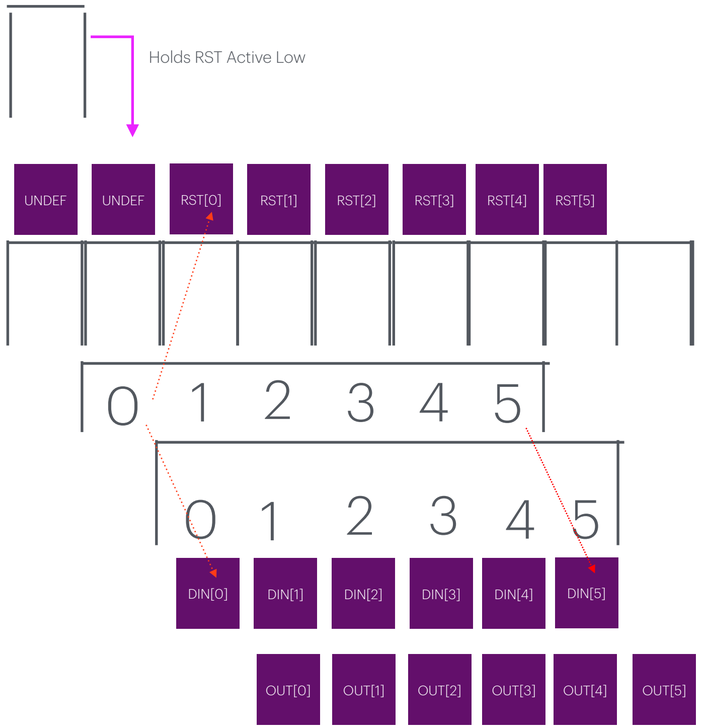


Serial to Parallel

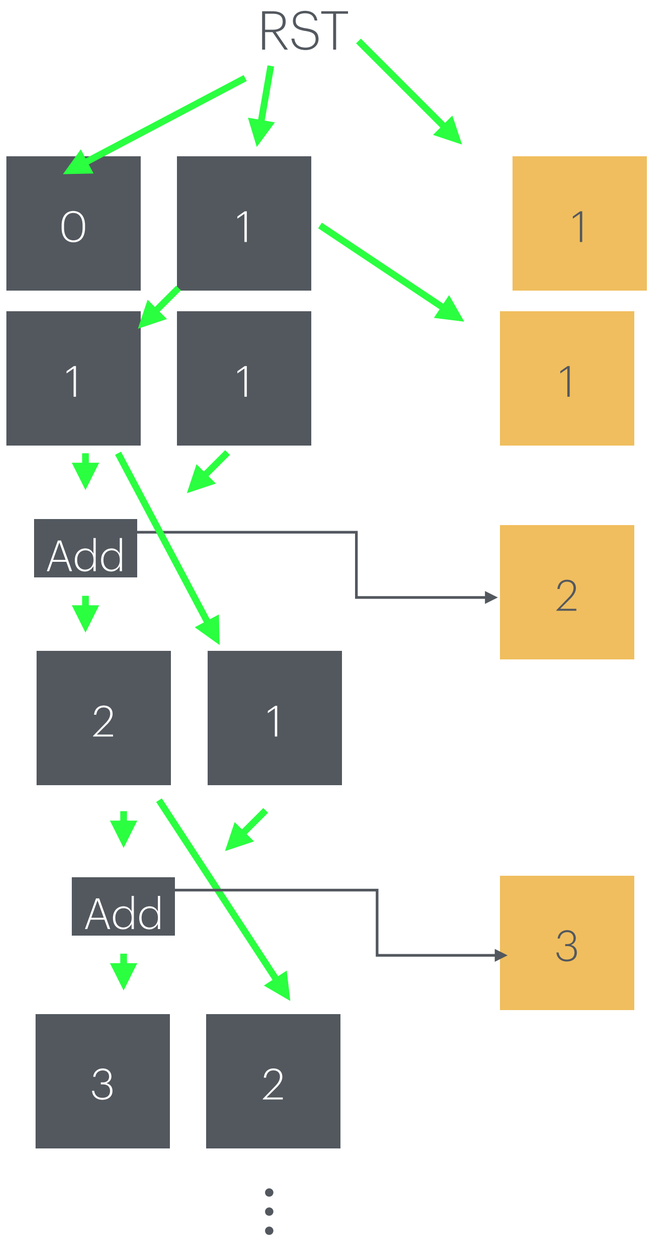




Serial to Parallel (Simulation Concept)

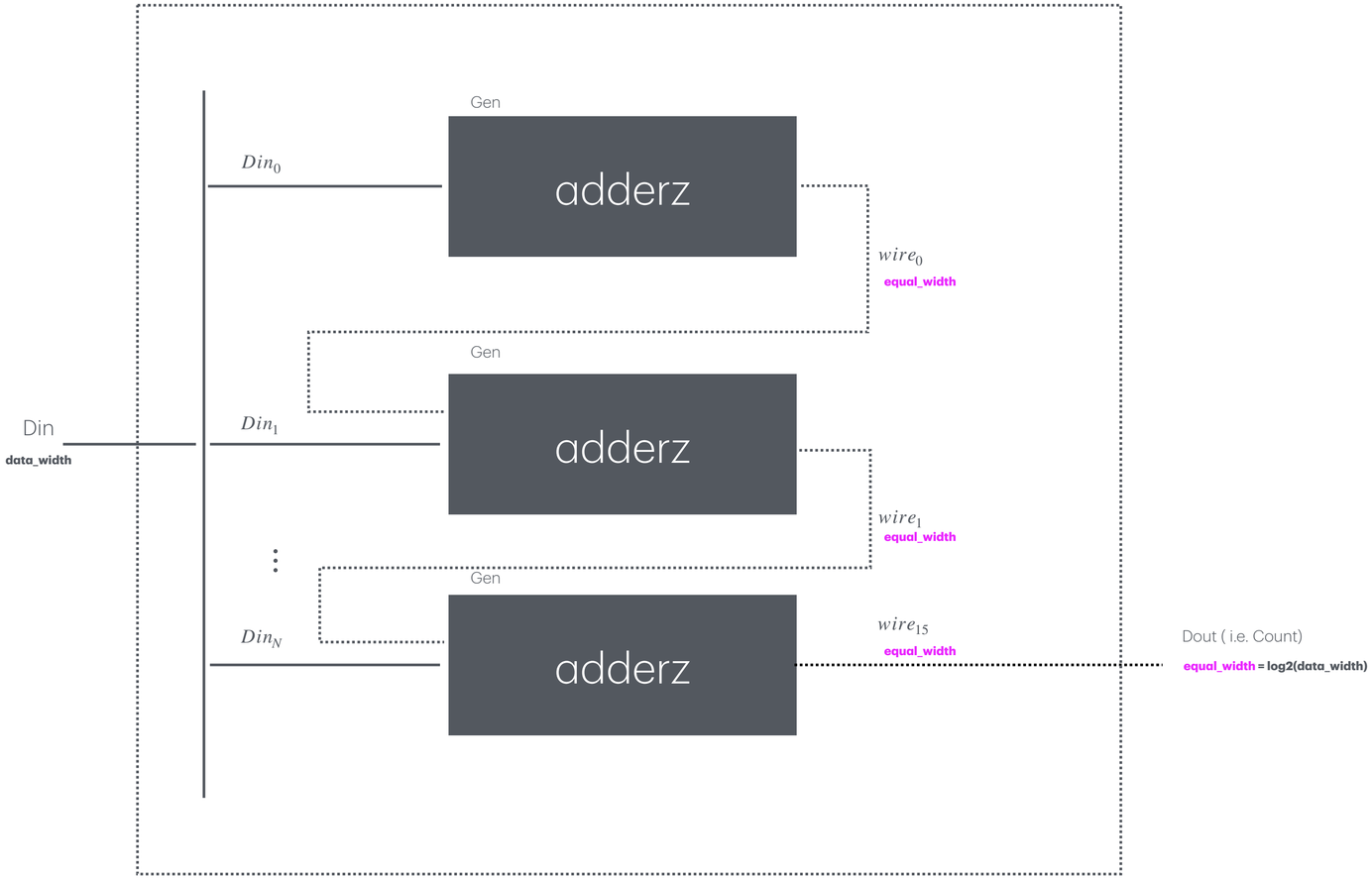


Fibonacci



Count Ones

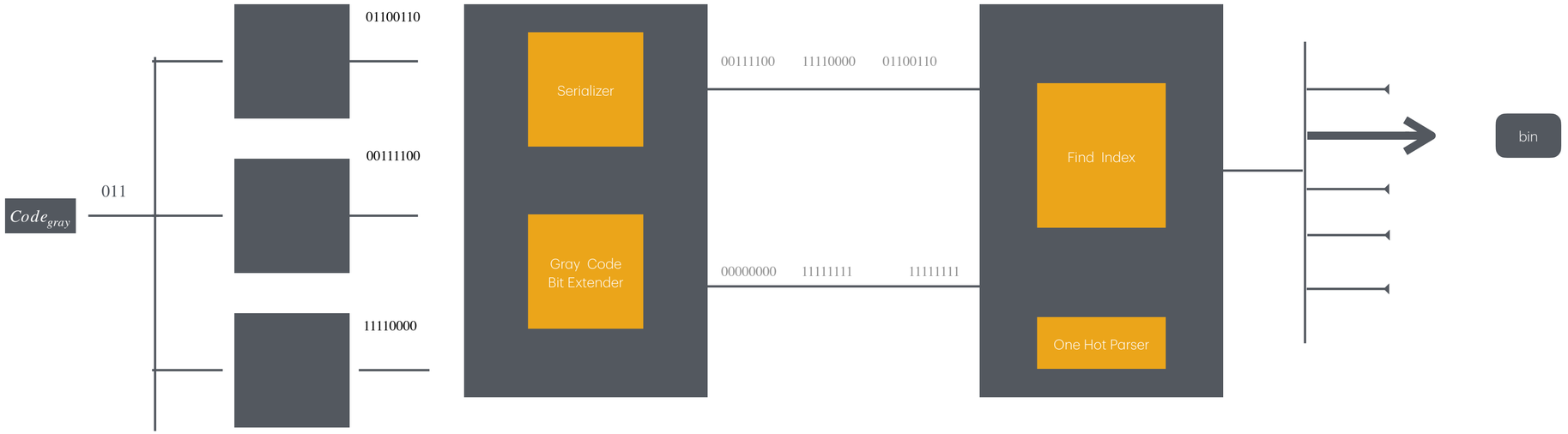
Architecture Similar to Linked List



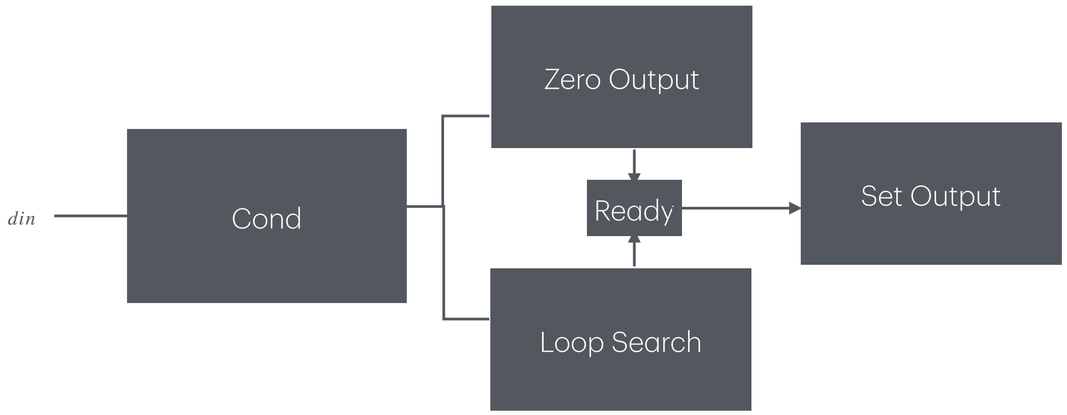
Count Ones

```
[2025-10-21 23:50:16 UTC] iverilog '-Wall' '-g2012' design.sv testbench.sv  && unbuffer vvp a.out
index -  0   input -     3   n_ones -  2
index -  1   input -     5   n_ones -  2
index -  2   input -     8   n_ones -  1
testbench.sv:44: $finish called at 9 (1s)
Done
```

Gray Code to Binary (Width = 3)



Trailing Ones

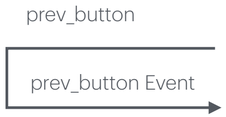


StopWatch Timer

TICK	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
START																								
RESET																								
STOP																								
COUNT	0	0	0	1	2	0	0	0	0	0	0	1	2	0	0	1	1	1	1	1	1	2	3	4

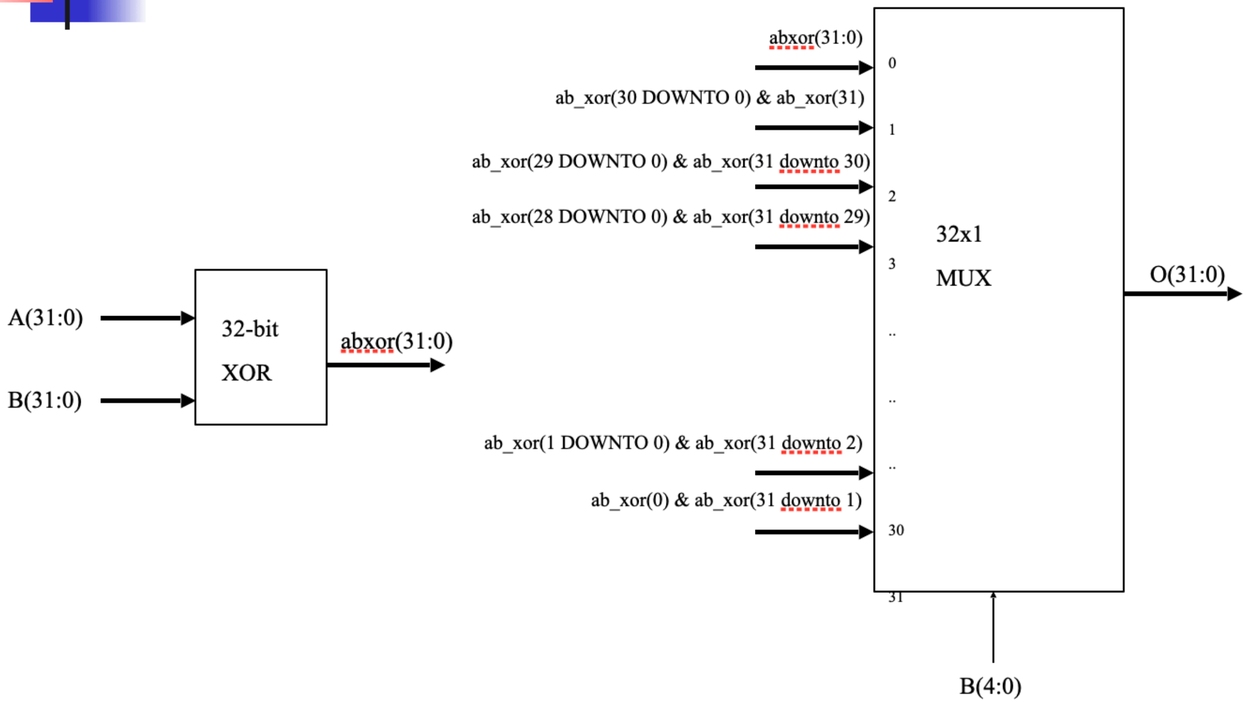
Testbench **monitors rdy** at this time stamp

StopWatch Timer



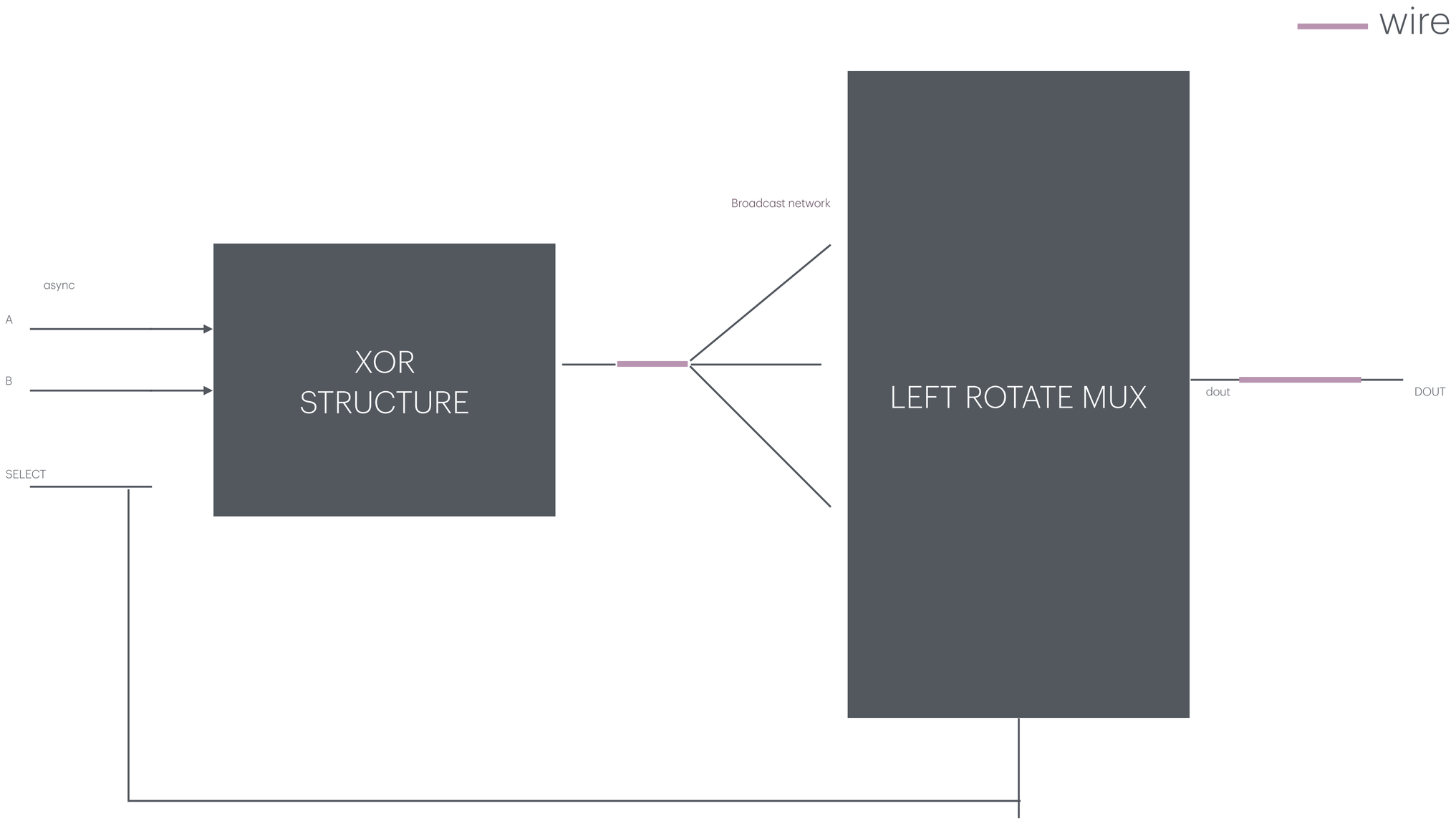

```
[2025-10-23 19:15:00 UTC] iverilog '-Wall' '-g2012' design.sv testbench.sv  && unbuffer vvp a.out
[  0] Button Press: reset[0] start[0] stop[0]  return -     0
[  1] Button Press: reset[0] start[0] stop[0]  return -     0
[  2] Button Press: reset[0] start[1] stop[0]  return -     0
[  3] Button Press: reset[0] start[0] stop[0]  return -     1
[  4] Button Press: reset[1] start[0] stop[0]  return -     2
[  5] Button Press: reset[0] start[0] stop[0]  return -     0
[  6] Button Press: reset[0] start[0] stop[0]  return -     0
[  7] Button Press: reset[0] start[1] stop[1]  return -     0
[  8] Button Press: reset[0] start[0] stop[0]  return -     0
[  9] Button Press: reset[0] start[0] stop[0]  return -     0
[ 10] Button Press: reset[0] start[1] stop[0]  return -     0
[ 11] Button Press: reset[0] start[0] stop[0]  return -     1
[ 12] Button Press: reset[1] start[1] stop[1]  return -     2
[ 13] Button Press: reset[0] start[0] stop[0]  return -     0
[ 14] Button Press: reset[0] start[1] stop[0]  return -     0
[ 15] Button Press: reset[0] start[0] stop[1]  return -     1
[ 16] Button Press: reset[0] start[0] stop[0]  return -     1
[ 17] Button Press: reset[0] start[0] stop[0]  return -     1
[ 18] Button Press: reset[0] start[0] stop[1]  return -     1
[ 19] Button Press: reset[0] start[0] stop[0]  return -     1
[ 20] Button Press: reset[0] start[1] stop[0]  return -     1
[ 21] Button Press: reset[0] start[0] stop[0]  return -     2
[ 22] Button Press: reset[0] start[0] stop[0]  return -     3
[ 23] Button Press: reset[0] start[0] stop[0]  return -     4
testbench.sv:136: $finish called at 114000 (1ps)
Done
```

O=A <<<B (Synthesis)

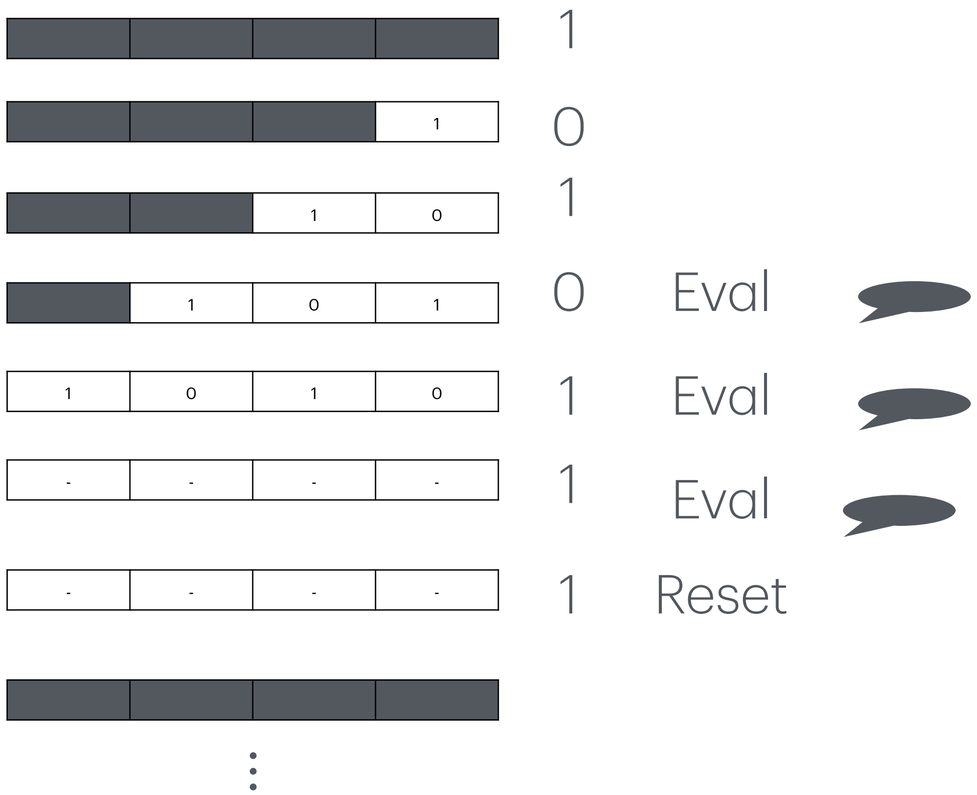


Circuit from OLD grad school slides :). Might as well build it in SV

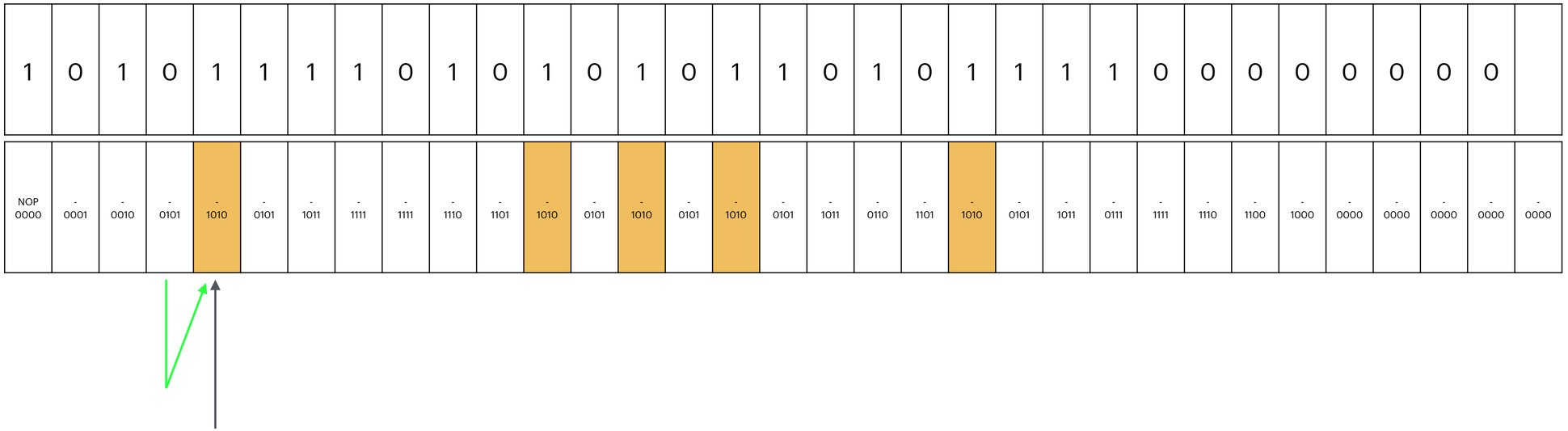
Random Circuit 1



Sequence Detector



Sequence Detector

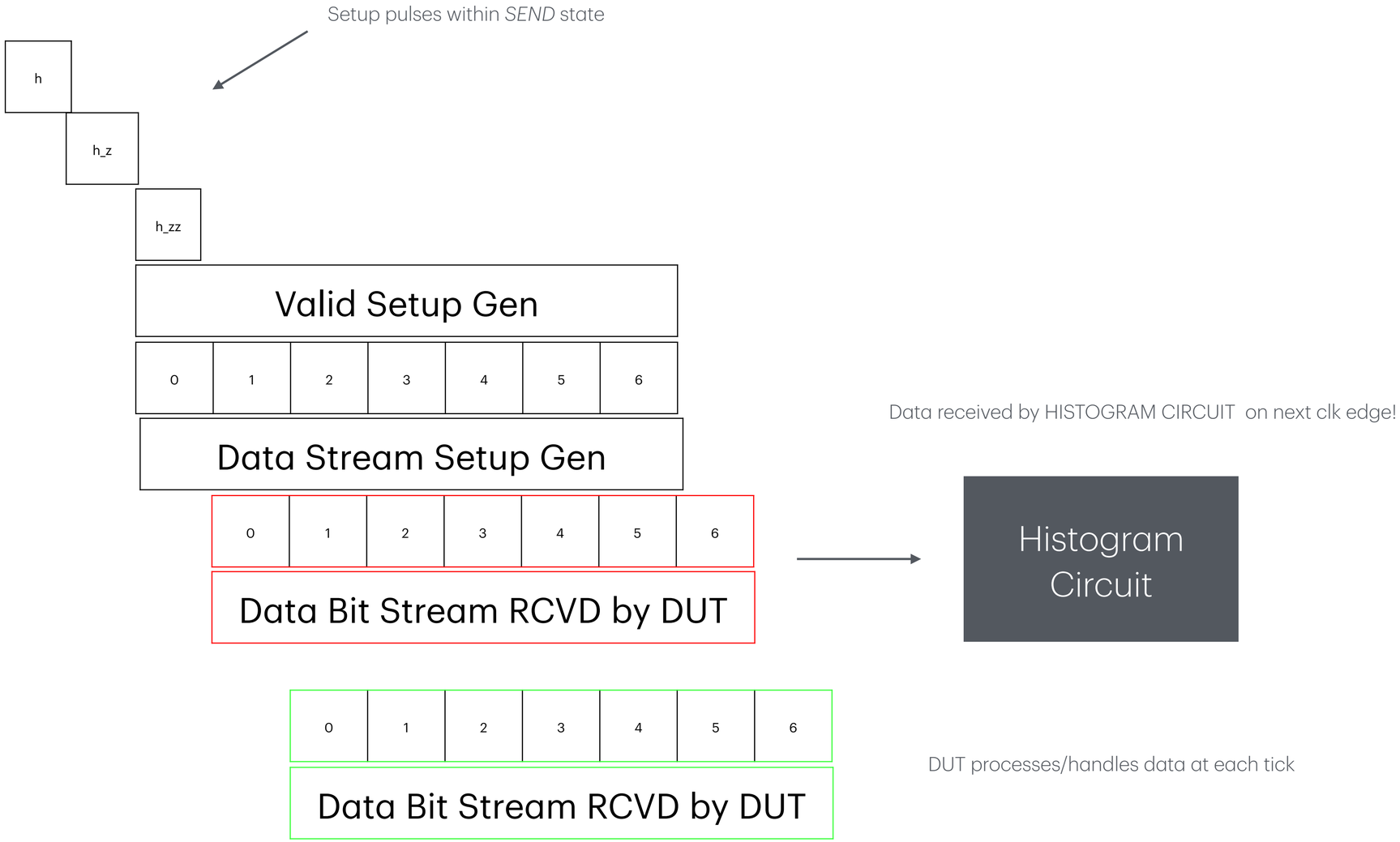


FIFO FULL

Evaluations of sequence are valid

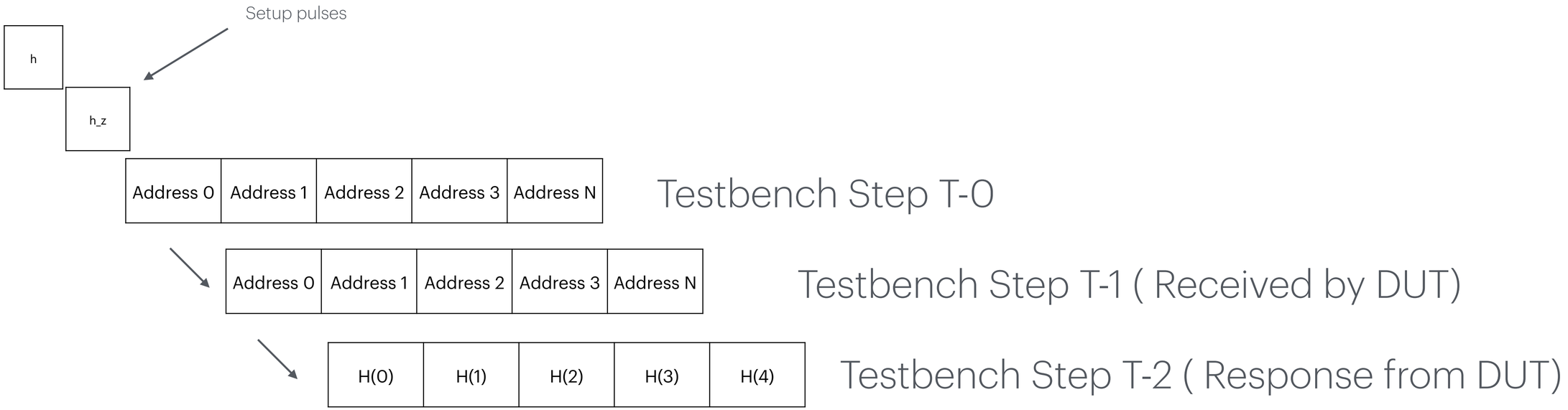
Histo Amazon

Send Mechanism

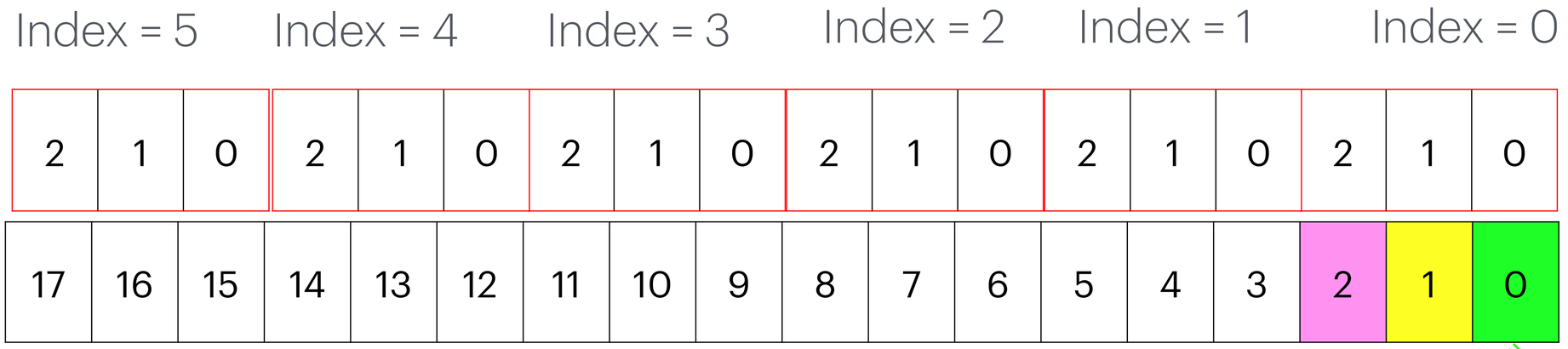


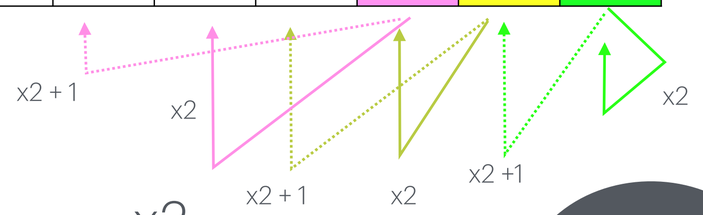
Histo Amazon

Receive Mechanism (Test Address)

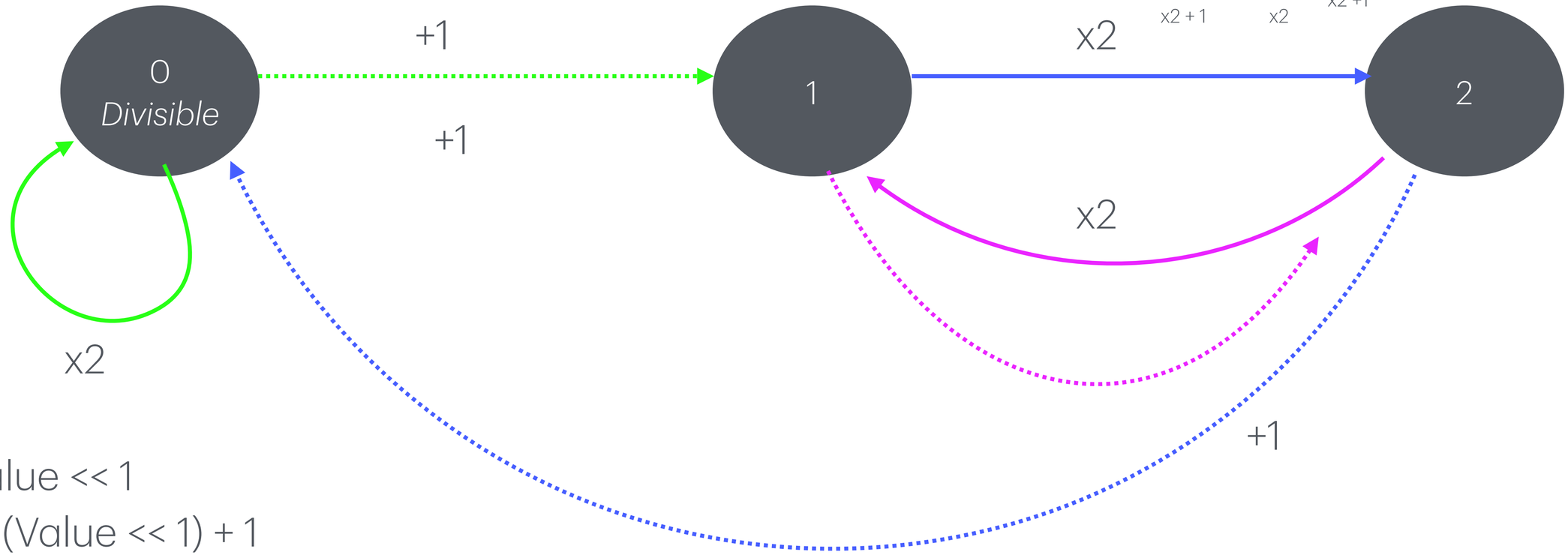


Divisible By Three





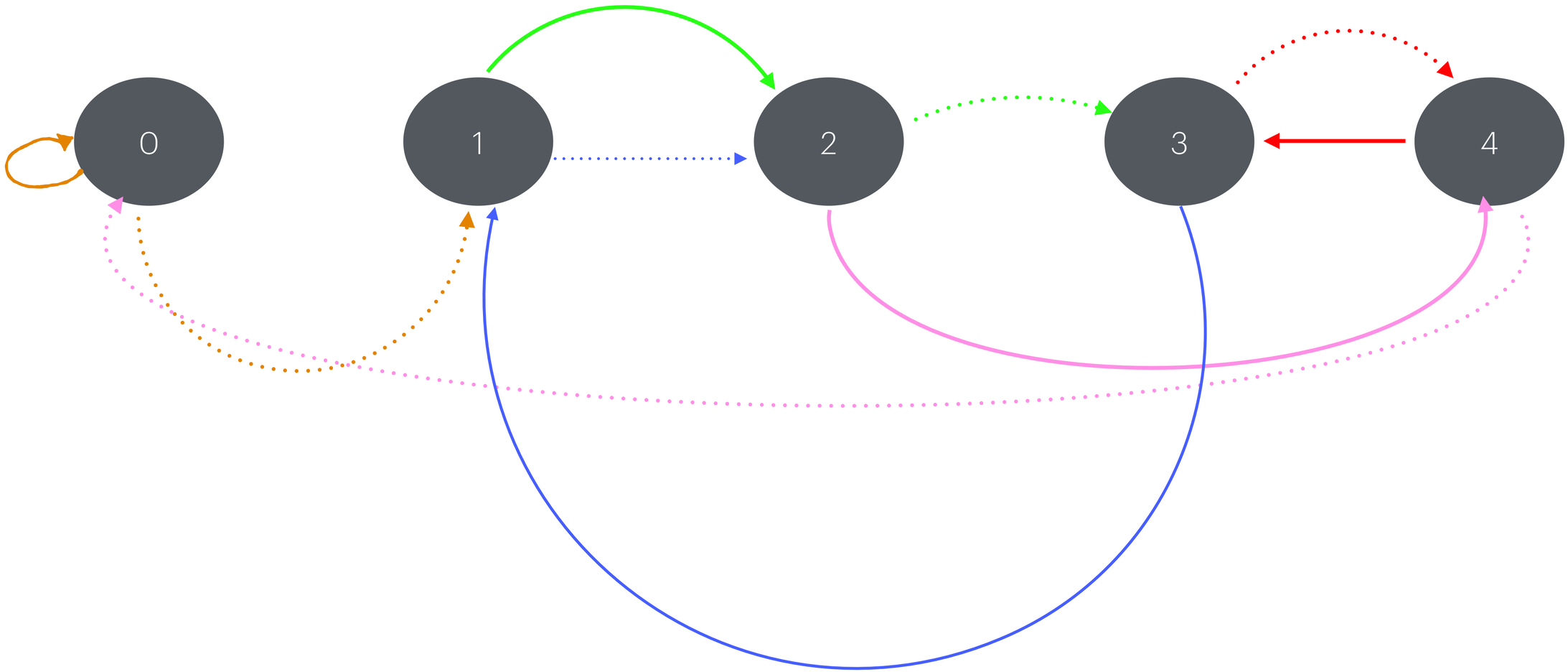
State Flow



x2 = Value << 1

x2 + 1= (Value << 1) + 1

Divisible By Five



Palindrome

Odd Data Width

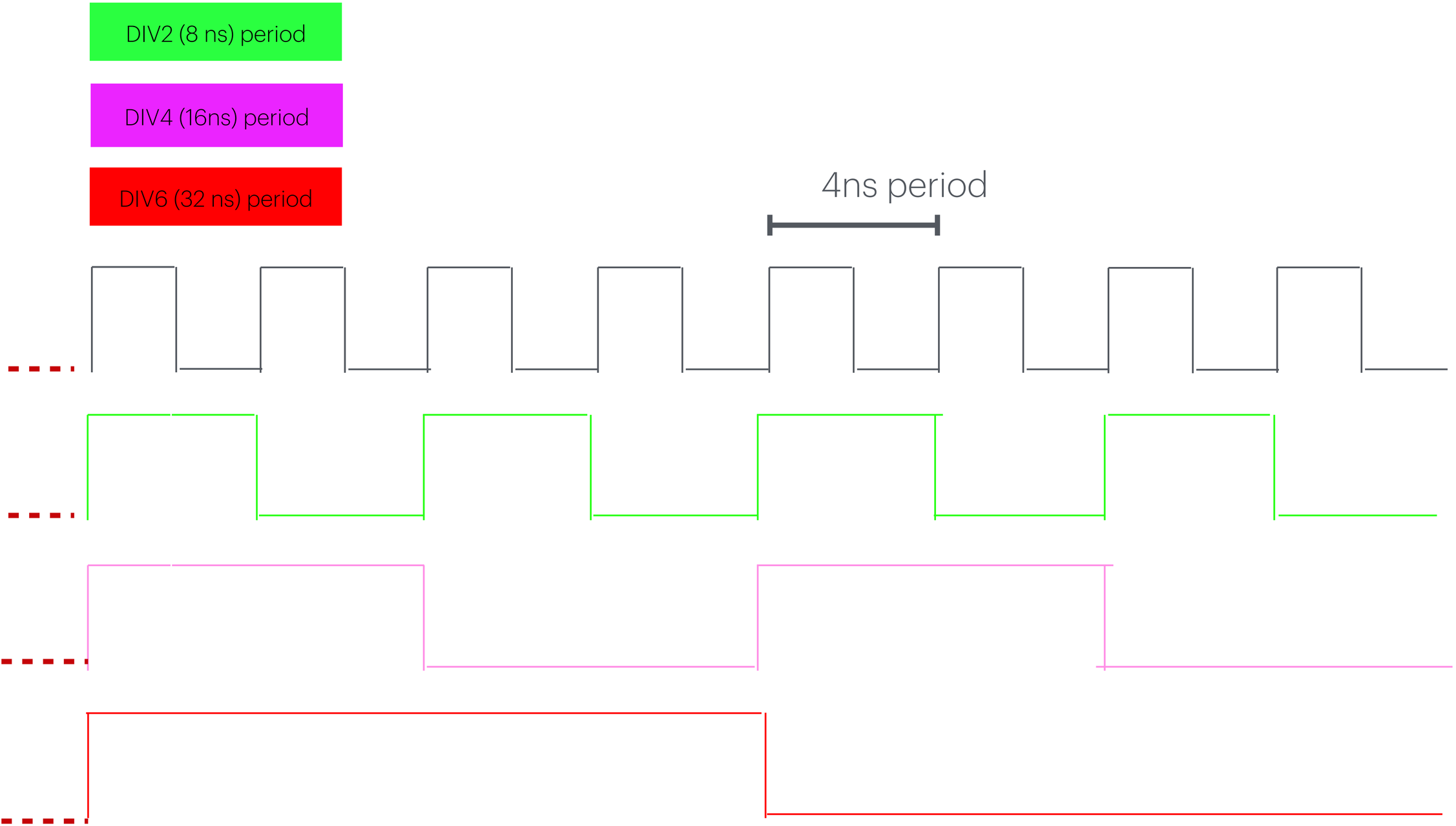
0	1	0	1	0

Half_Size_Floored = 2

Even Data Width

0	1	1	1

Divide-By-Events



Divide-By-Events Timing