ĐẠI HỌC QUỐC GIA THÀNH PHỐ HỒ CHÍ MINH

TRƯỜNG ĐẠI HỌC CÔNG NGHỆ THÔNG TIN

KHOA KỸ THUẬT MÁY TÍNH

BÁO CÁO LAB 02 & 03

MÔN THIẾT KỸ THUẬT THIẾT KẾ KIỂM TRA

HỌ VÀ TÊN: Vòng Chí Cường – 21521910

LỚP: CE 409.O21

GIẢNG VIÊN HƯỚNG DẪN

Phạm Thanh Hùng

TP. HỒ CHÍ MINH – Tháng 04 năm 2024

1. Plan a check list which will list all test cases to cover all functions of your processor

Ta sẽ có 2 trường hợp test case

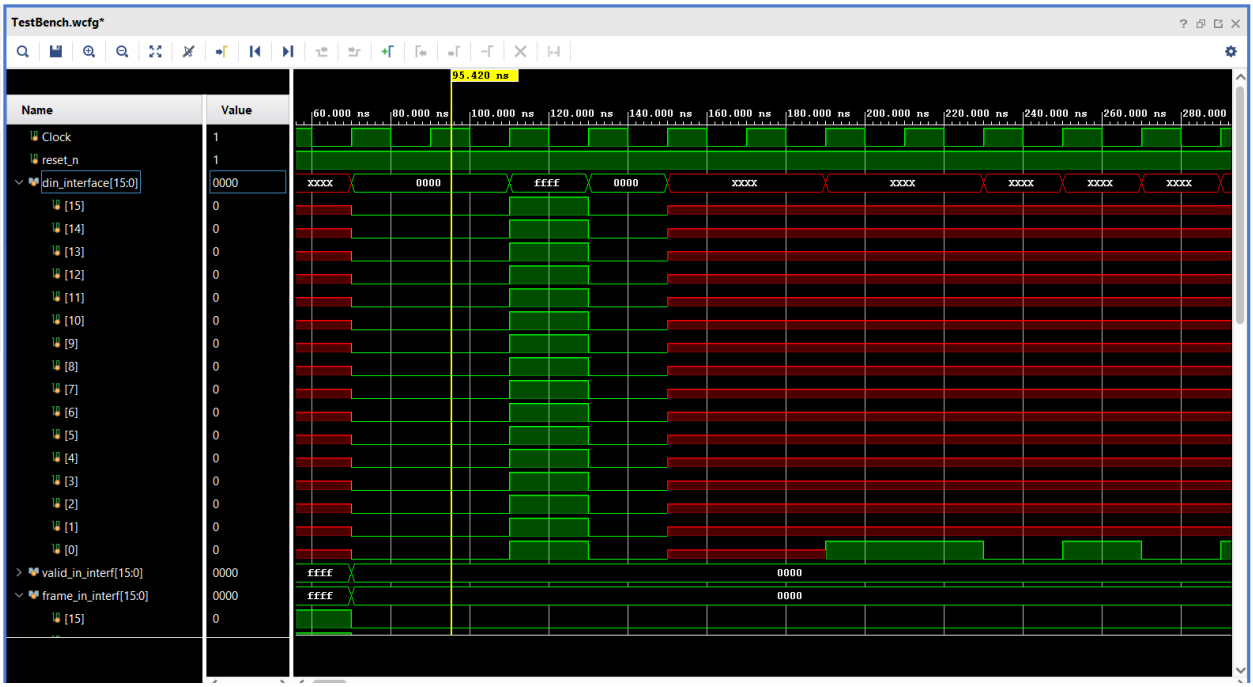
+ 16 port in → 1 port out at the same time.

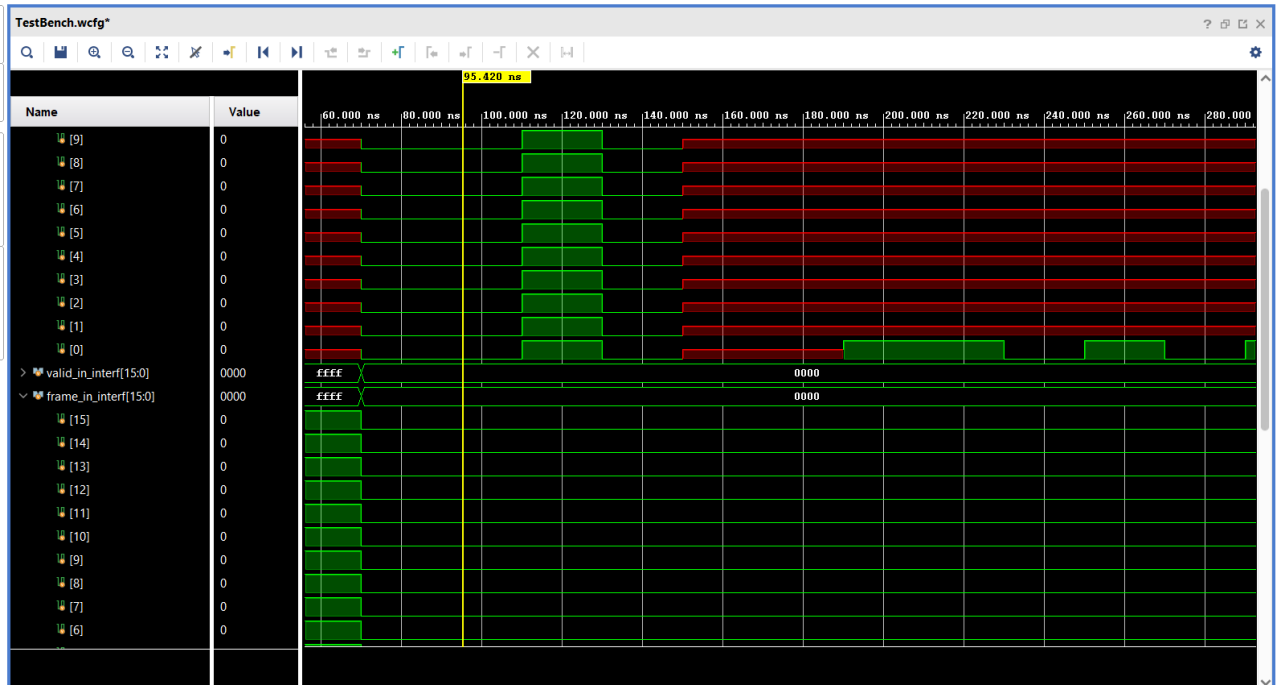
+ 16 port in → random 16 port out at the same time.

2. Compile and simulate the design using Vivado tool.

1. Trường hợp 1: test 16 port in cùng truy suất ra 1 port out là port 4

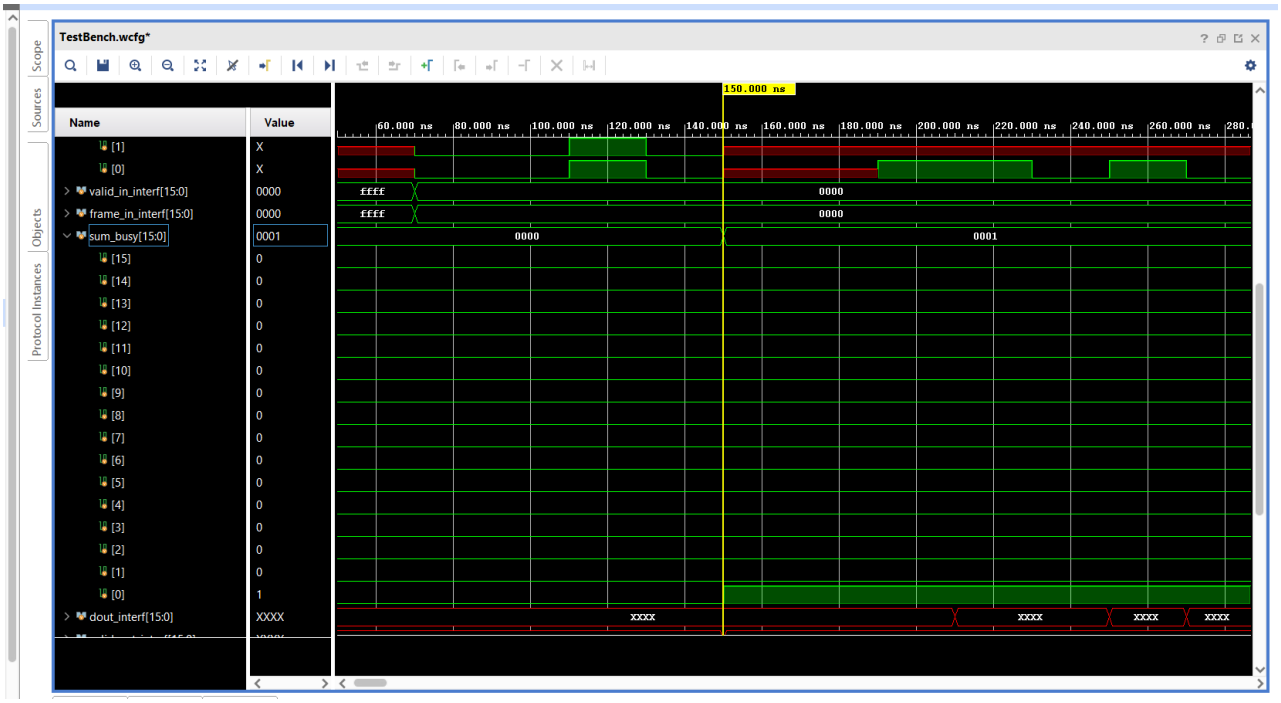
Kết quả test bench :



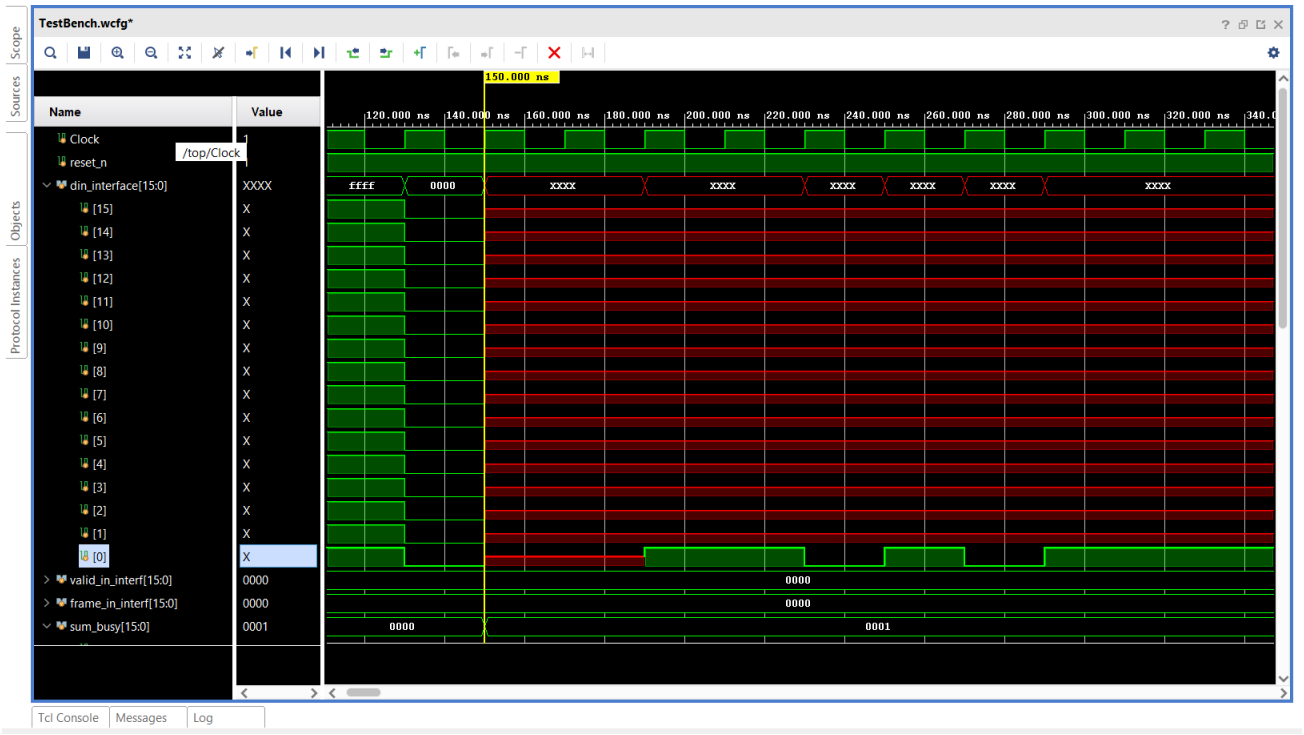


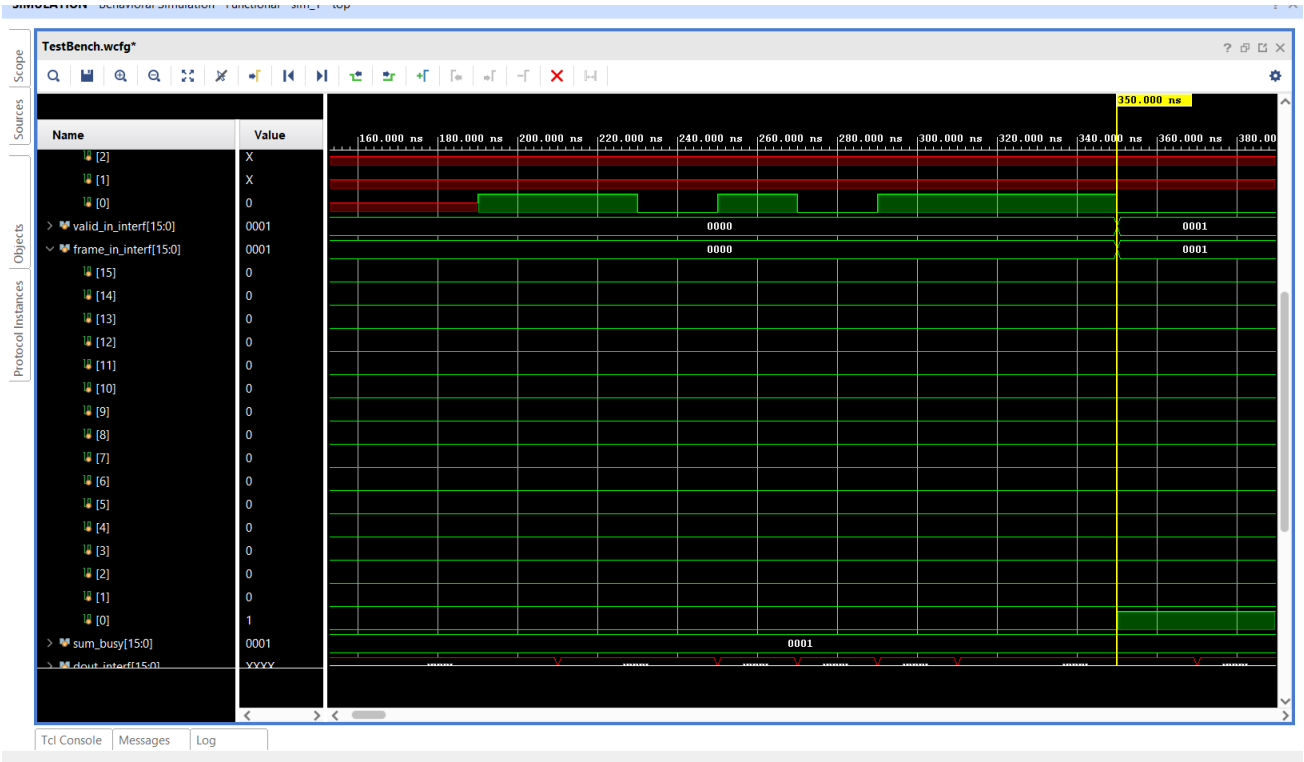
- 4 chu kỳ đầu sau khi frame in kéo xuống 0, ta truyền vào input interface địa chỉ port out là 4 (0100) theo thứ tự từ LSB đến MSB.

- Đồng thời lúc này sum_busy của port[0] cũng kéo lên 1 cho phép port 0 bắt đầu truyền data.

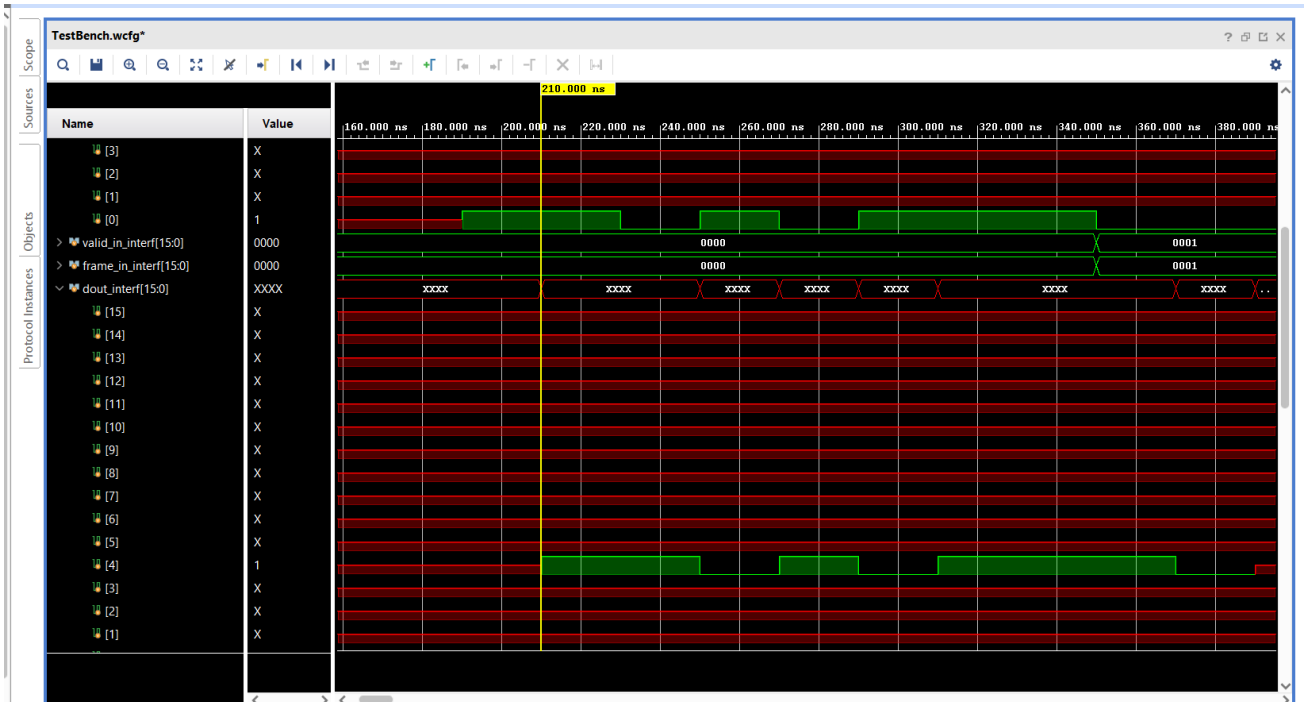


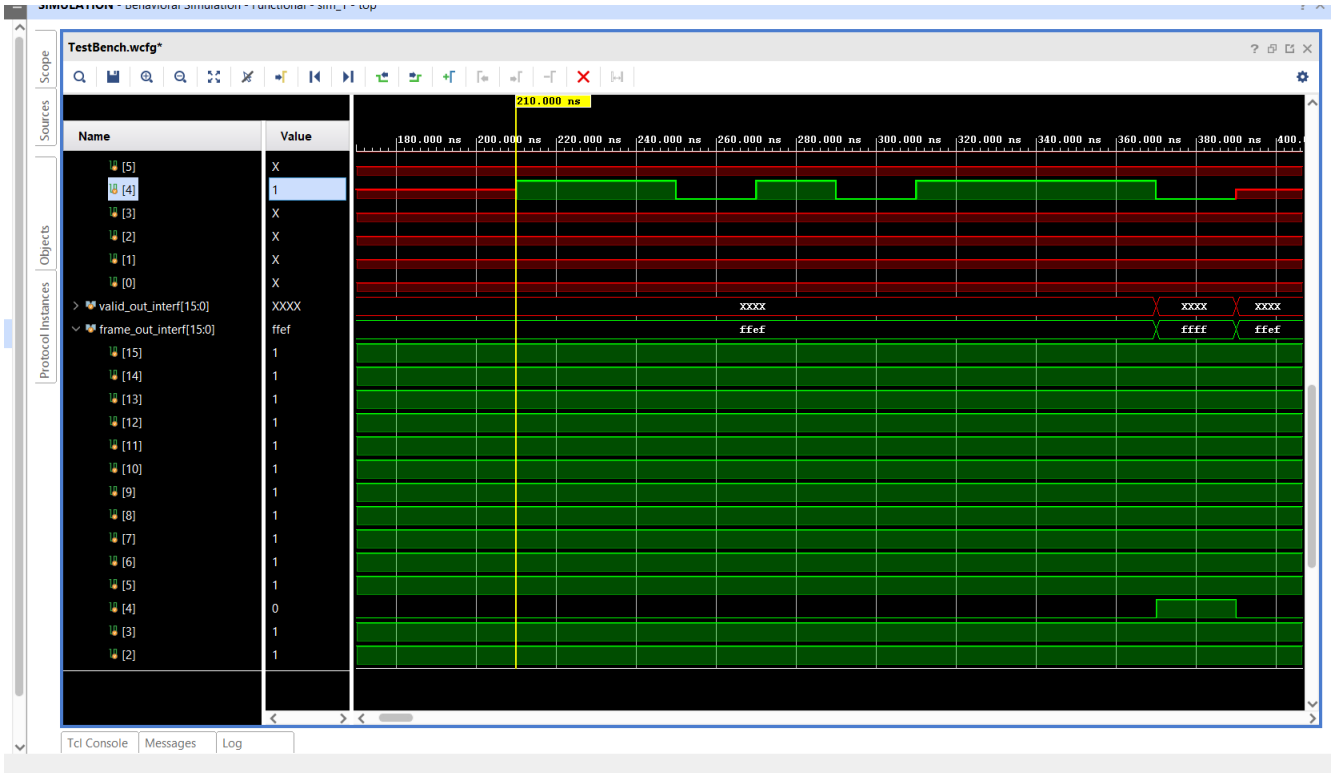
- Sau đó port[0] sẽ truyền padding (X) 2 chu kỳ mới bắt đầu truyền data là : d7 (1101_0111) theo thứ tự từ MSB đến LSB, sau đó sau khi truyền hết kéo frame_in[0] lên 1 :



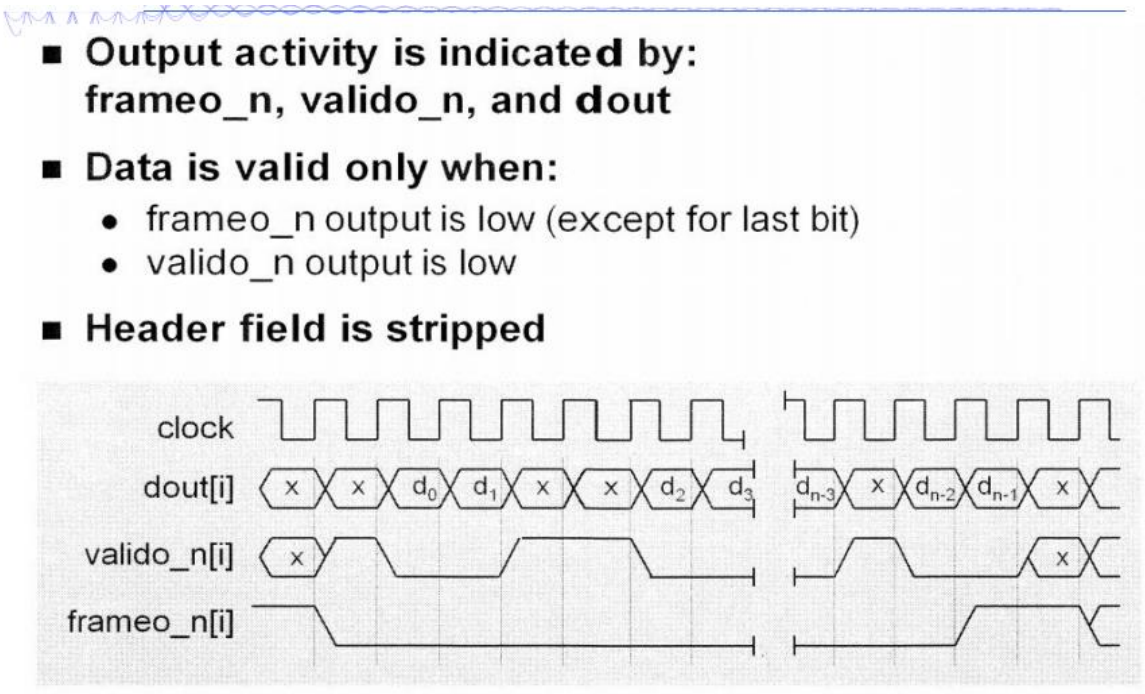


- Dout interface bị delay mất 1 chu kỳ xung clock mới nhận được data đầu vào từ input interface ở port 4 :

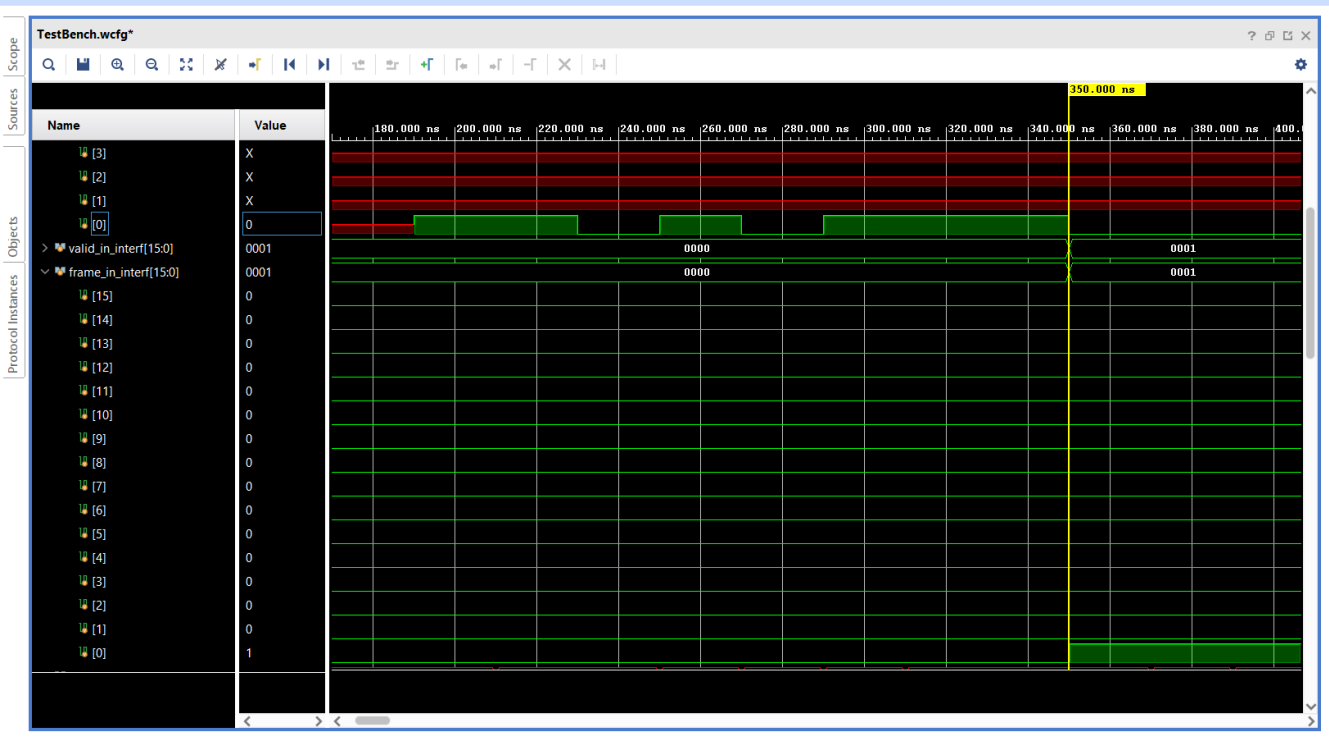

TestBench.wcfg*
Scope
Sources
Objects
Protocol Instances
Name
Value
210.000 ns
160.000 ns
180.000 ns
200.000 ns
220.000 ns
240.000 ns
260.000 ns
280.000 ns
300.000 ns
320.000 ns
340.000 ns
360.000 ns
380.000 ns
[3] X
[2] X
[1] X
[0] 1
valid_in_interf[15:0] 0000
frame_in_interf[15:0] 0000
dout_interf[15:0] XXXX
[15] X
[14] X
[13] X
[12] X
[11] X
[10] X
[9] X
[8] X
[7] X
[6] X
[5] X
[4] 1
[3] X
[2] X
[1] X
0000
0001
0000
0001
XXXX

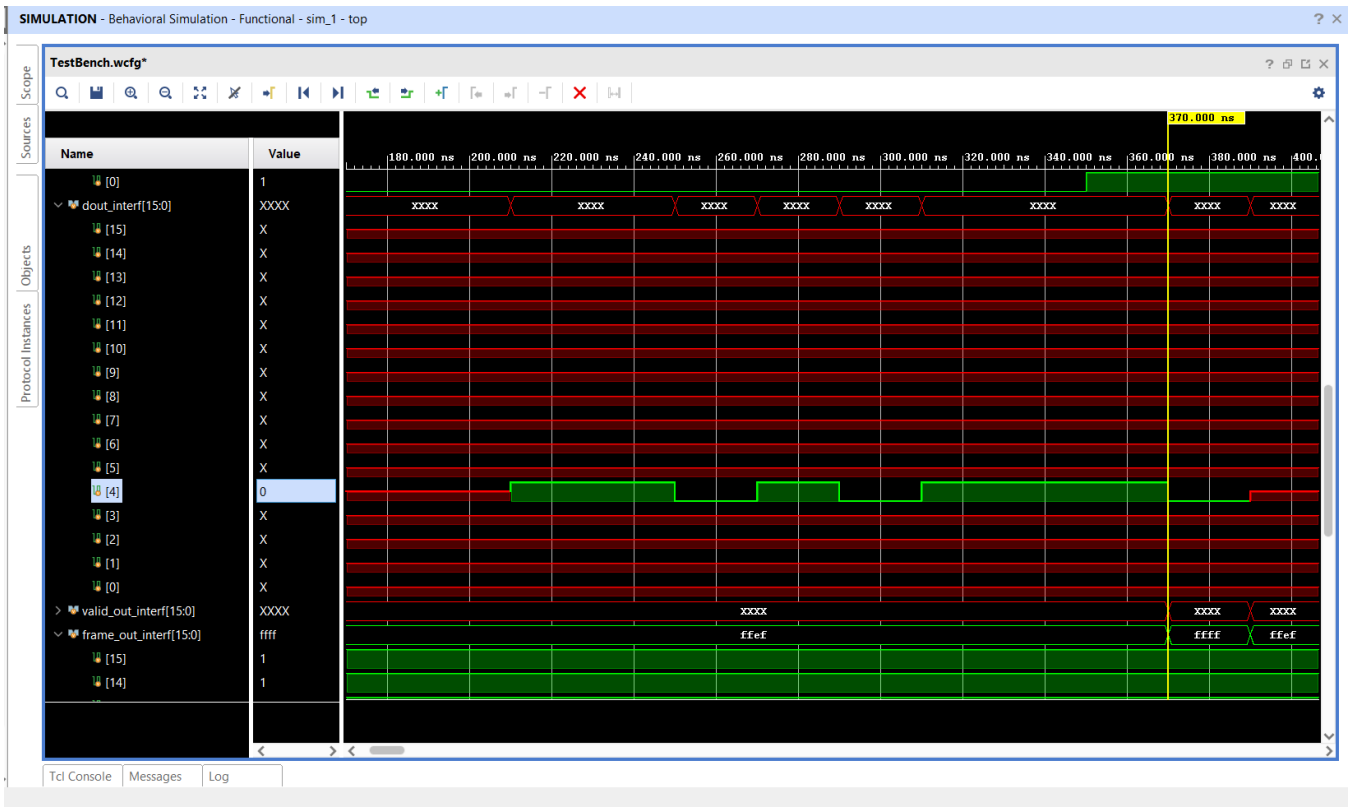

TestBench.wcfg*
Scope
Sources
Objects
Protocol Instances
Name
Value
210.000 ns
180.000 ns
200.000 ns
220.000 ns
240.000 ns
260.000 ns
280.000 ns
300.000 ns
320.000 ns
340.000 ns
360.000 ns
380.000 ns
[5] X
[4] 1
[3] X
[2] X
[1] X
[0] X
valid_out_interf[15:0] XXXX
frame_out_interf[15:0] fffe
[15] 1
[14] 1
[13] 1
[12] 1
[11] 1
[10] 1
[9] 1
[8] 1
[7] 1
[6] 1
[5] 1
[4] 0
[3] 1
[2] 1
XXXX
XXXX
XXXX
fffe
ffff
fffe
Tcl Console
Messages
Log

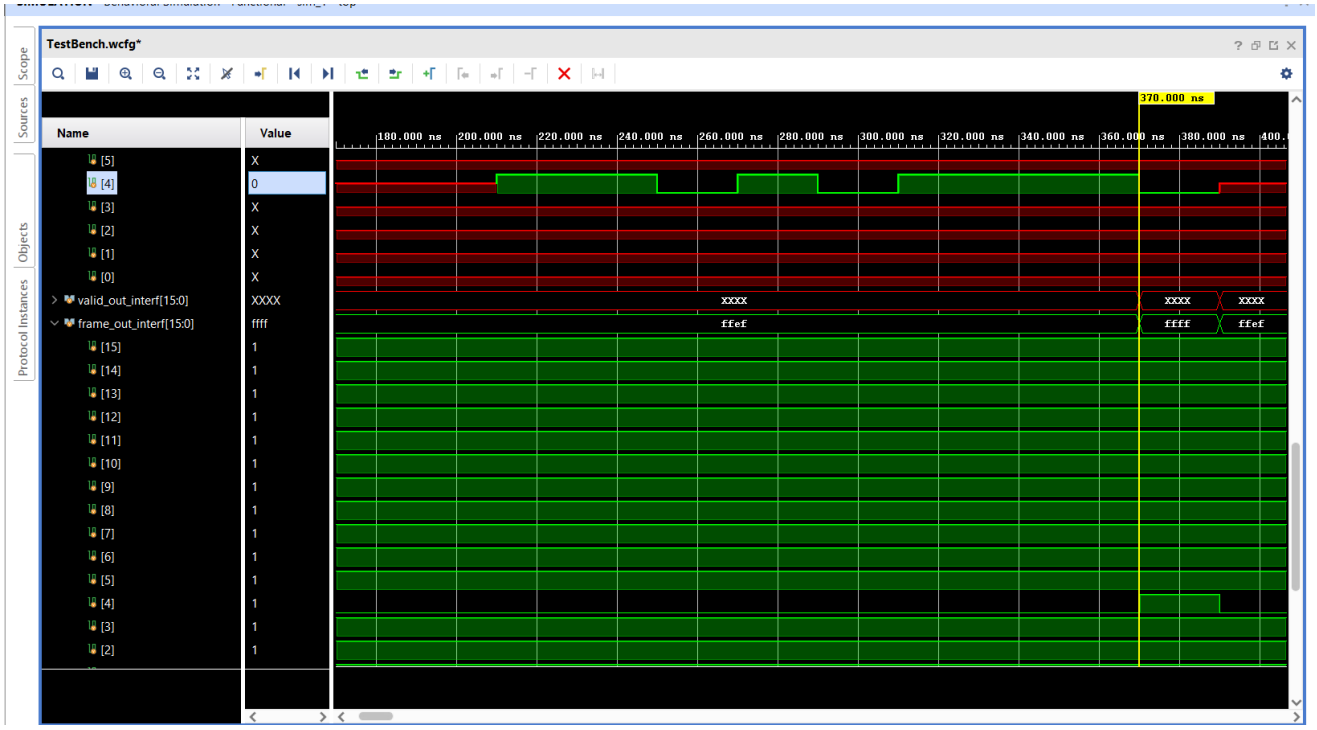
- Ở đây ta thấy, khi frame_out lên 1, dout sẽ nhận dữ liệu cuối cùng từ din n-1 theo hình sau :



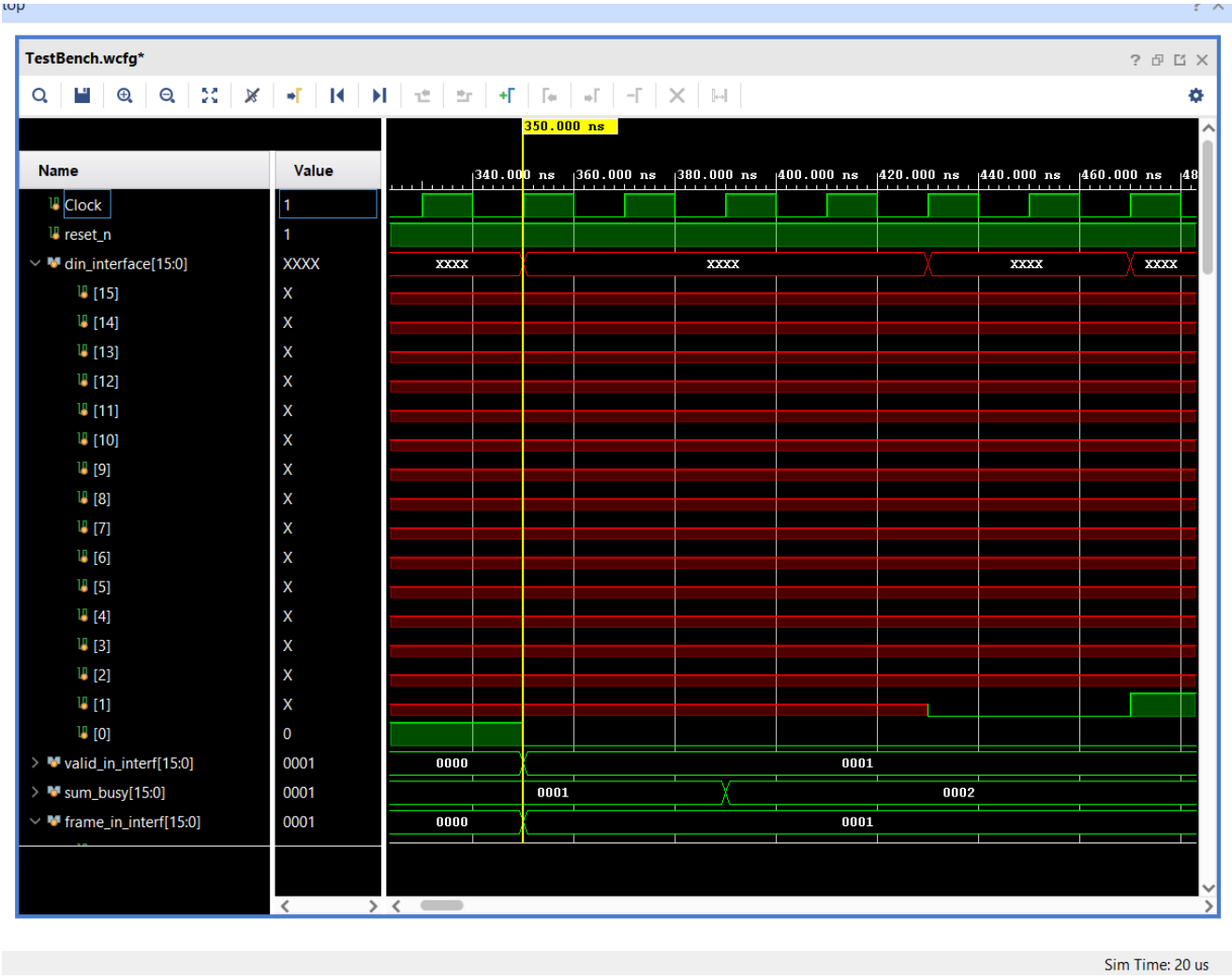
- Vì din[0] = 0 tại thời điểm frame_in[0] chuyển lên 1 nên dout[4] = 0 khi frame_out[4] chuyển lên 1 :

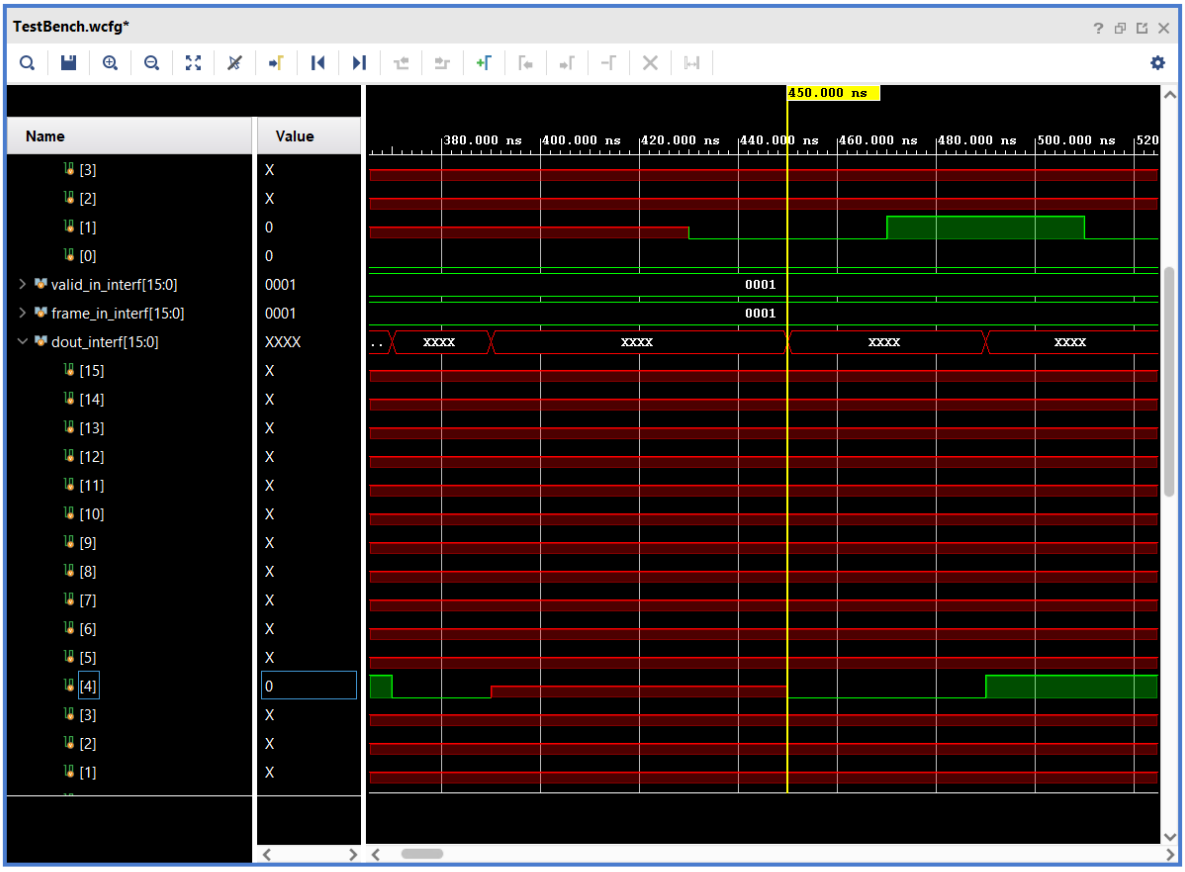



SIMULATION - Behavioral Simulation - Functional - sim_1 - top
TestBench.wcfg*
Scope
Sources
Objects
Protocol Instances
Name
Value
[0] 1
dout_interf[15:0] XXXX
[15] X
[14] X
[13] X
[12] X
[11] X
[10] X
[9] X
[8] X
[7] X
[6] X
[5] X
[4] 0
[3] X
[2] X
[1] X
[0] X
valid_out_interf[15:0] XXXX
frame_out_interf[15:0] ffff
[15] 1
[14] 1
370.000 ns
180.000 ns
200.000 ns
220.000 ns
240.000 ns
260.000 ns
280.000 ns
300.000 ns
320.000 ns
340.000 ns
360.000 ns
380.000 ns
XXXX
ffef
ffff
Tcl Console
Messages
Log

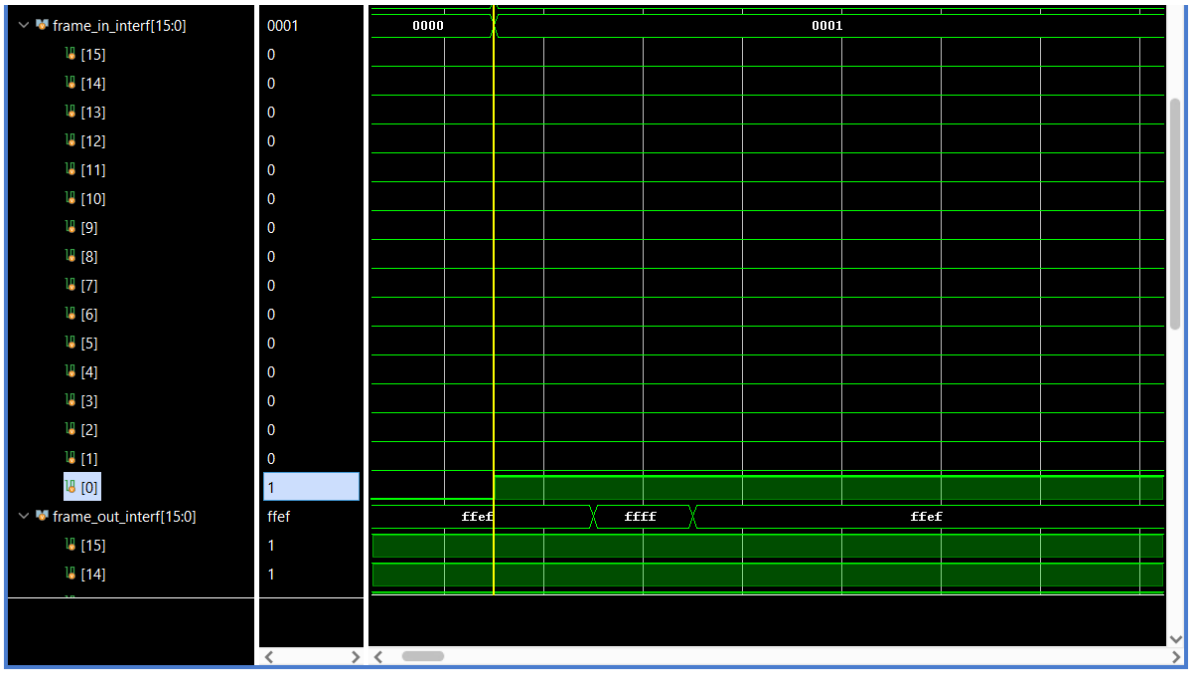

TestBench.wcfg*
Scope
Sources
Objects
Protocol Instances
Name
Value
[5] X
[4] 0
[3] X
[2] X
[1] X
[0] X
valid_out_interf[15:0] XXXX
frame_out_interf[15:0] ffff
[15] 1
[14] 1
[13] 1
[12] 1
[11] 1
[10] 1
[9] 1
[8] 1
[7] 1
[6] 1
[5] 1
[4] 1
[3] 1
[2] 1
370.000 ns
180.000 ns
200.000 ns
220.000 ns
240.000 ns
260.000 ns
280.000 ns
300.000 ns
320.000 ns
340.000 ns
360.000 ns
380.000 ns
XXXX
ffef
ffff

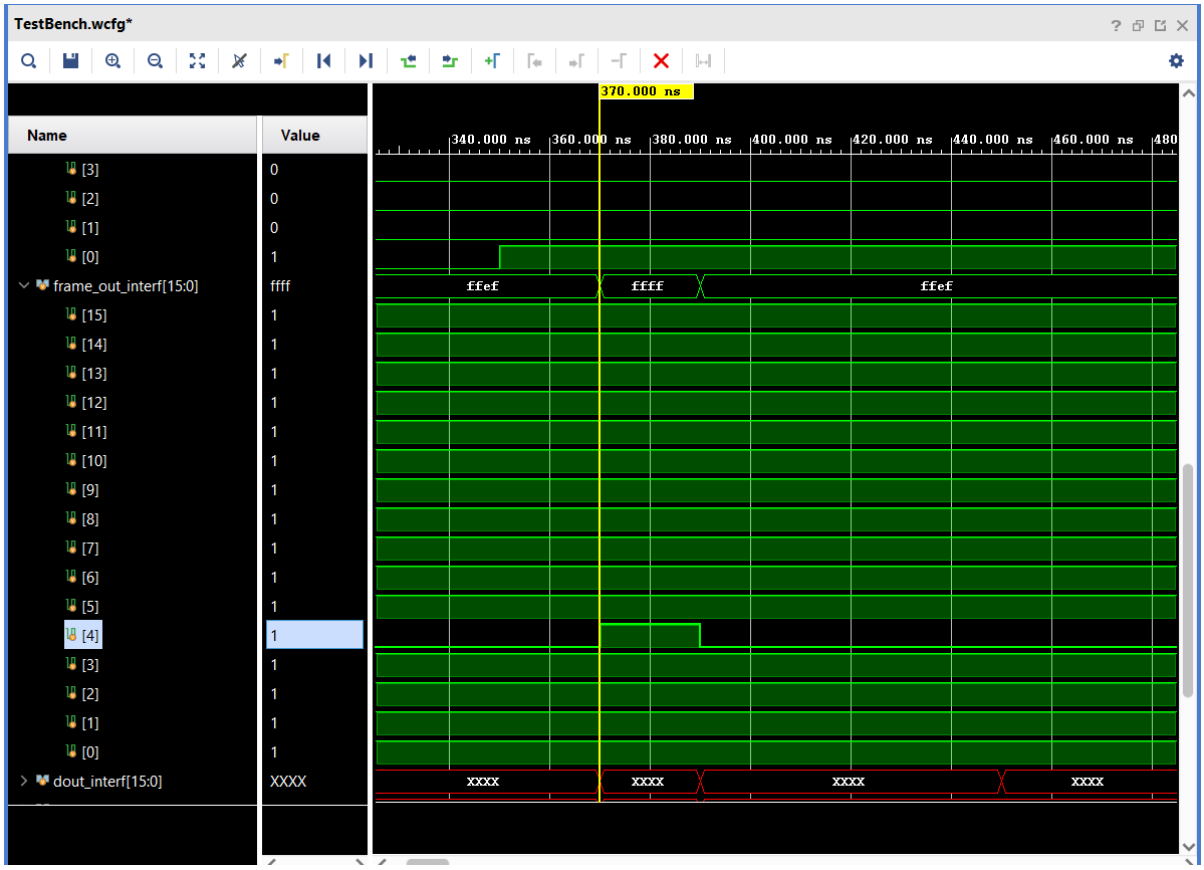
- Sau khi frame_in port[0] lên 1, ta delay thêm 2 chu kỳ để chuyển sum_busy từ port_in[0] xuống 0 và port_in[1] lên 1 cho phép port[1] bắt đầu truyền data. Vì khi port 1 bắt đầu truyền data, nó sẽ mất thêm 2 chu kỳ để truyền padding, sau đó mới truyền data, nên ta mất 4 chu kỳ kể từ thời điểm frame_in[0] lên 1 để din[1] bắt đầu truyền data là 37 (0011_0111) :



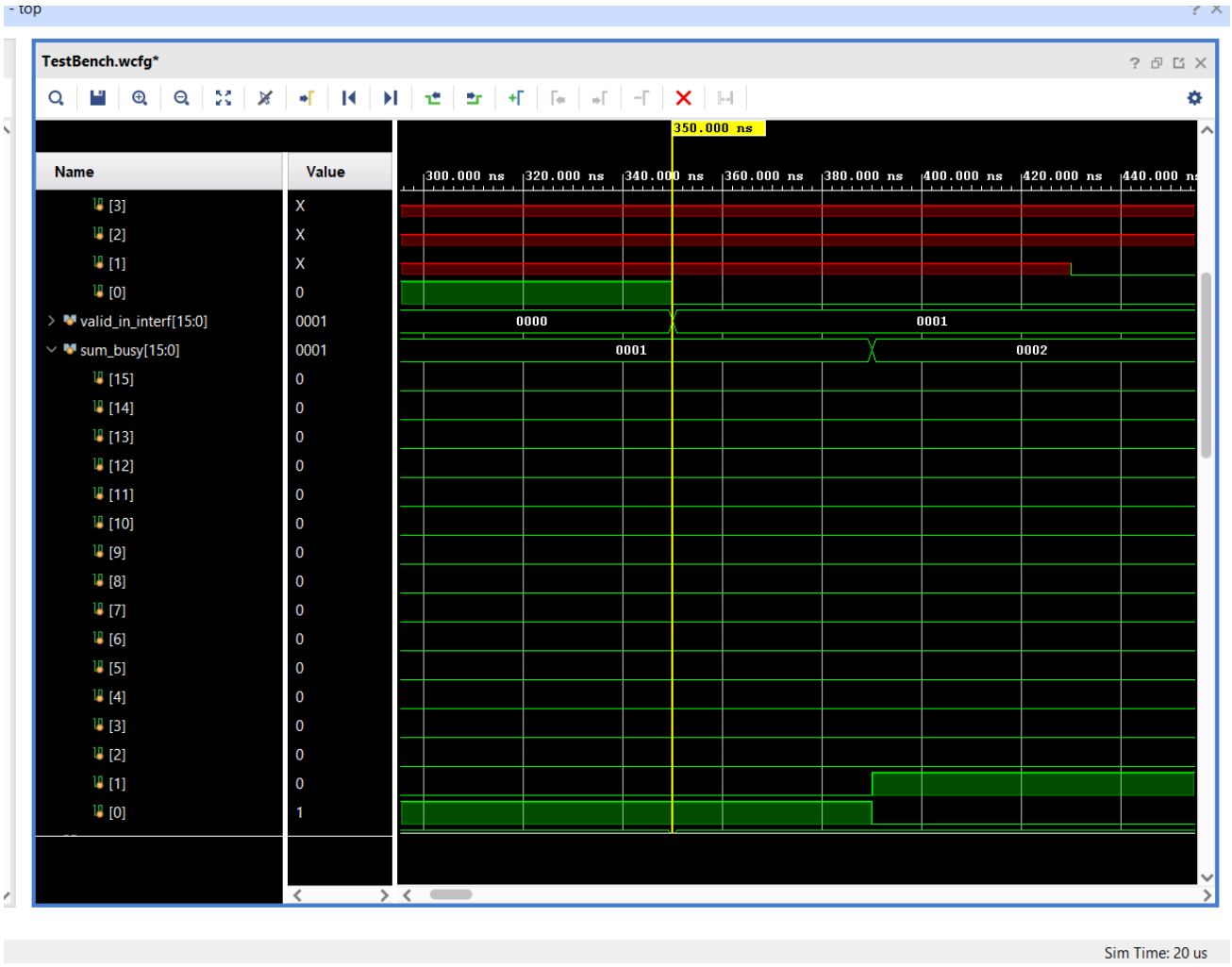


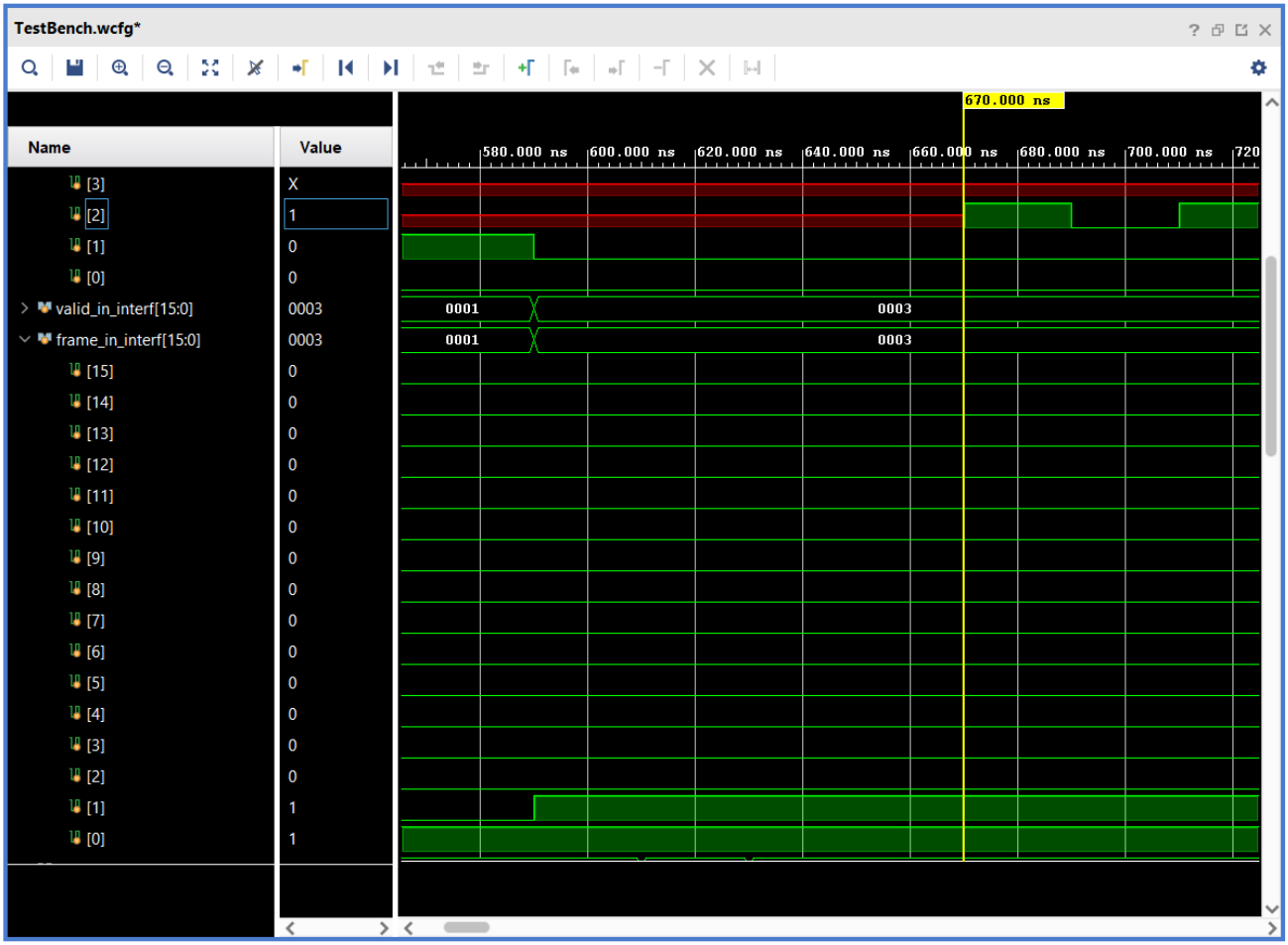
Sim Time: 20 us



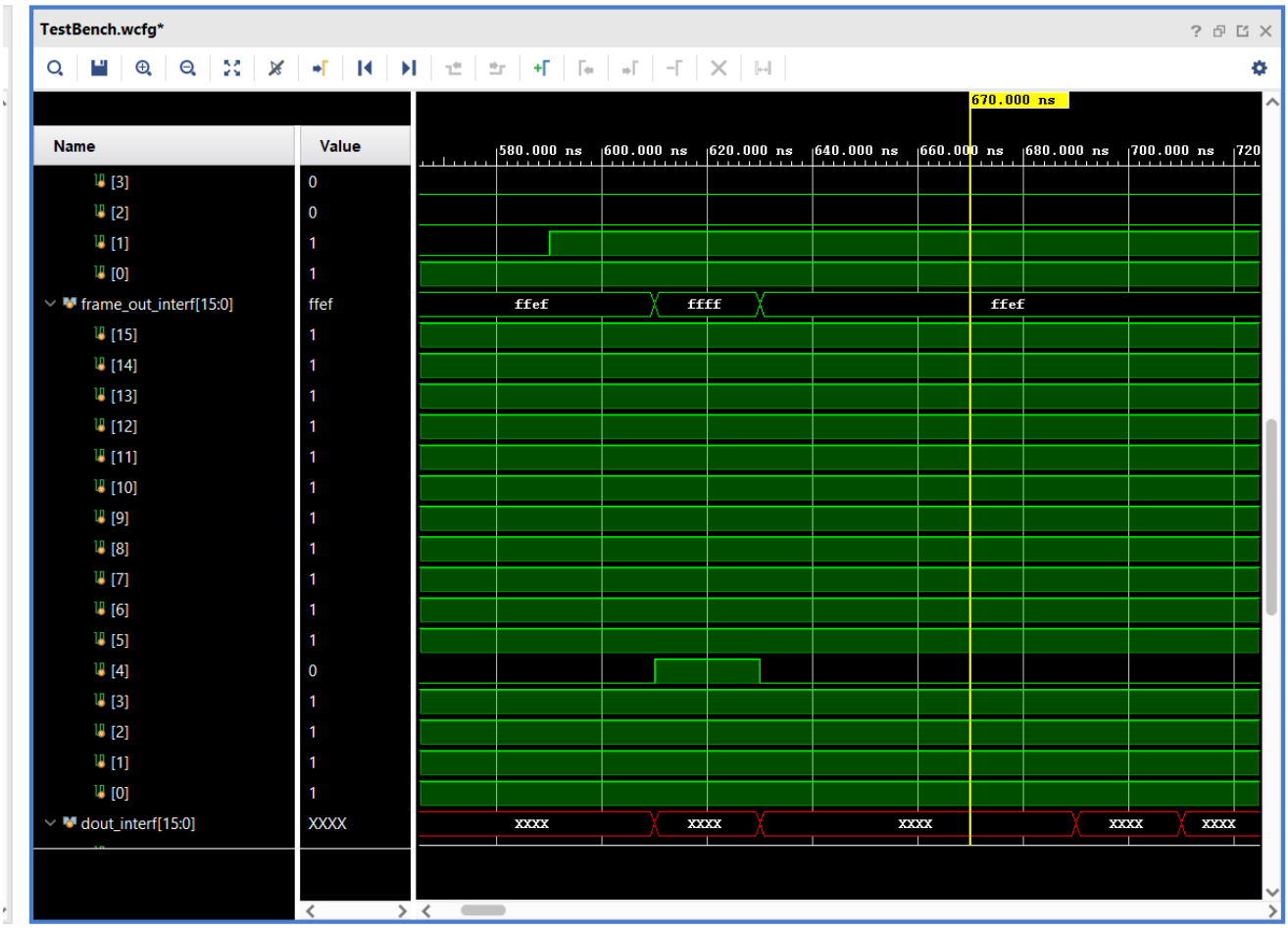

TestBench.wcfg*
Name
Value
[3]
0
[2]
0
[1]
0
[0]
1
frame_out_interf[15:0]
ffff
[15]
1
[14]
1
[13]
1
[12]
1
[11]
1
[10]
1
[9]
1
[8]
1
[7]
1
[6]
1
[5]
1
[4]
1
[3]
1
[2]
1
[1]
1
[0]
1
dout_interf[15:0]
XXXX
370.000 ns
340.000 ns
360.000 ns
380.000 ns
400.000 ns
420.000 ns
440.000 ns
460.000 ns
480
ffef
ffff
ffef
xxxx
xxxx
xxxx
xxxx

- Tương tự cho port in [2] với data a4 :

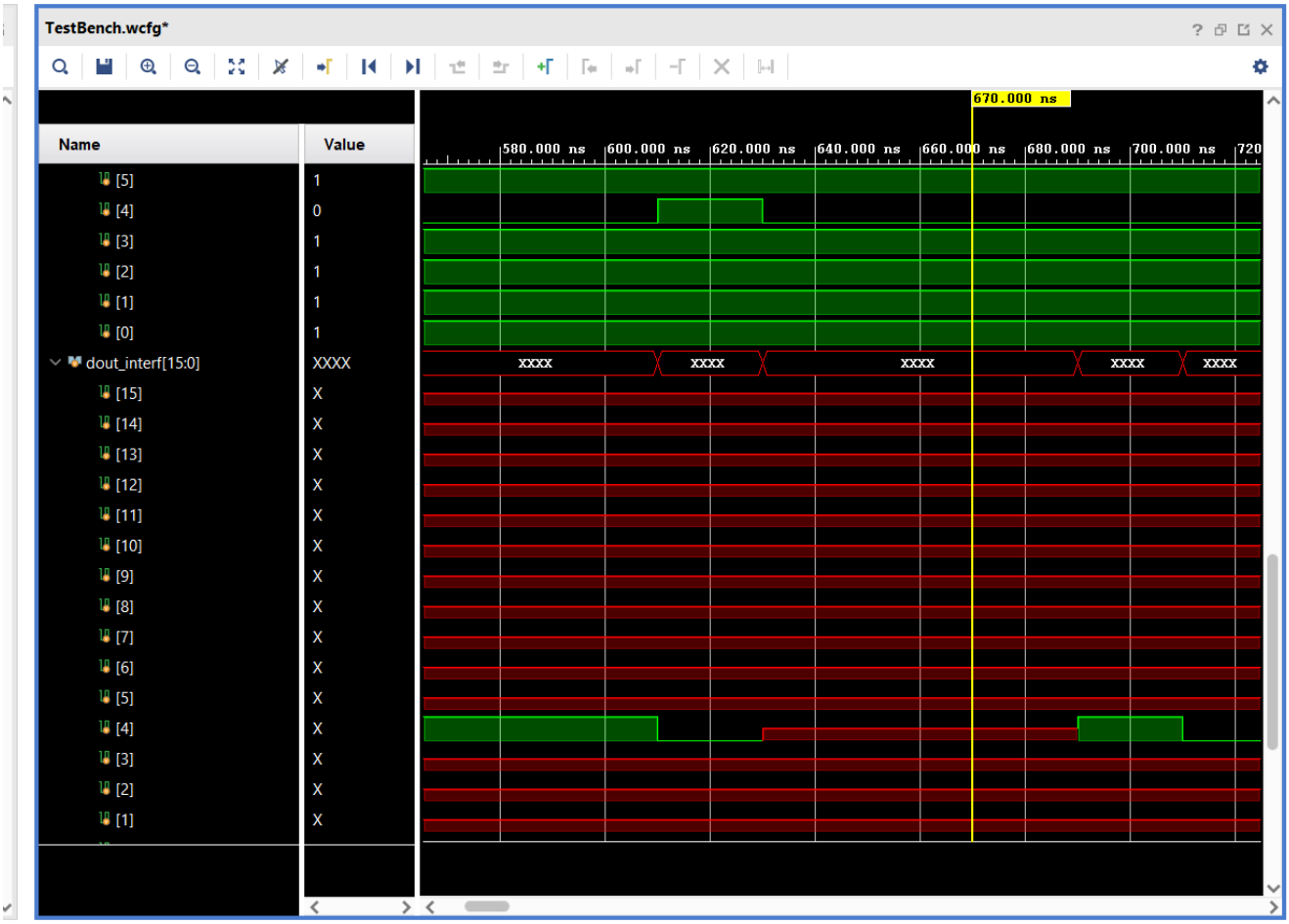




Sim Time: 20 us



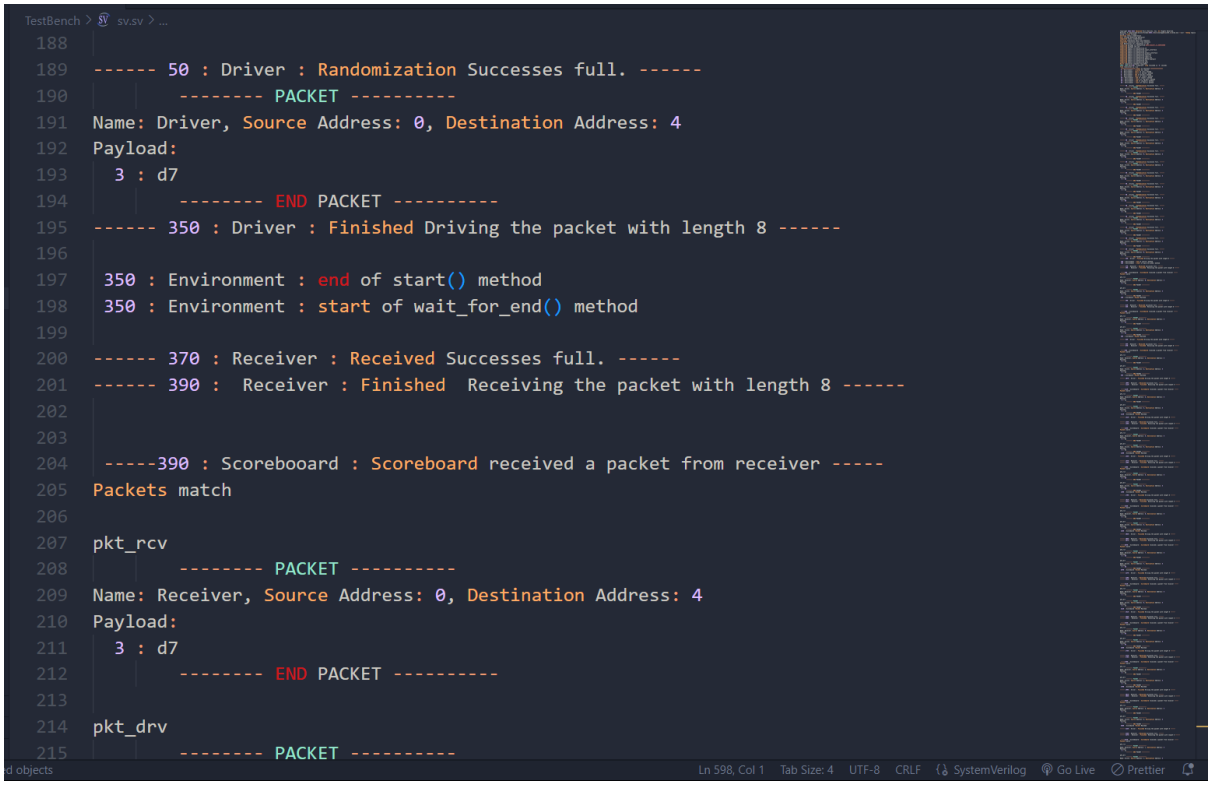
Sim Time: 20 us



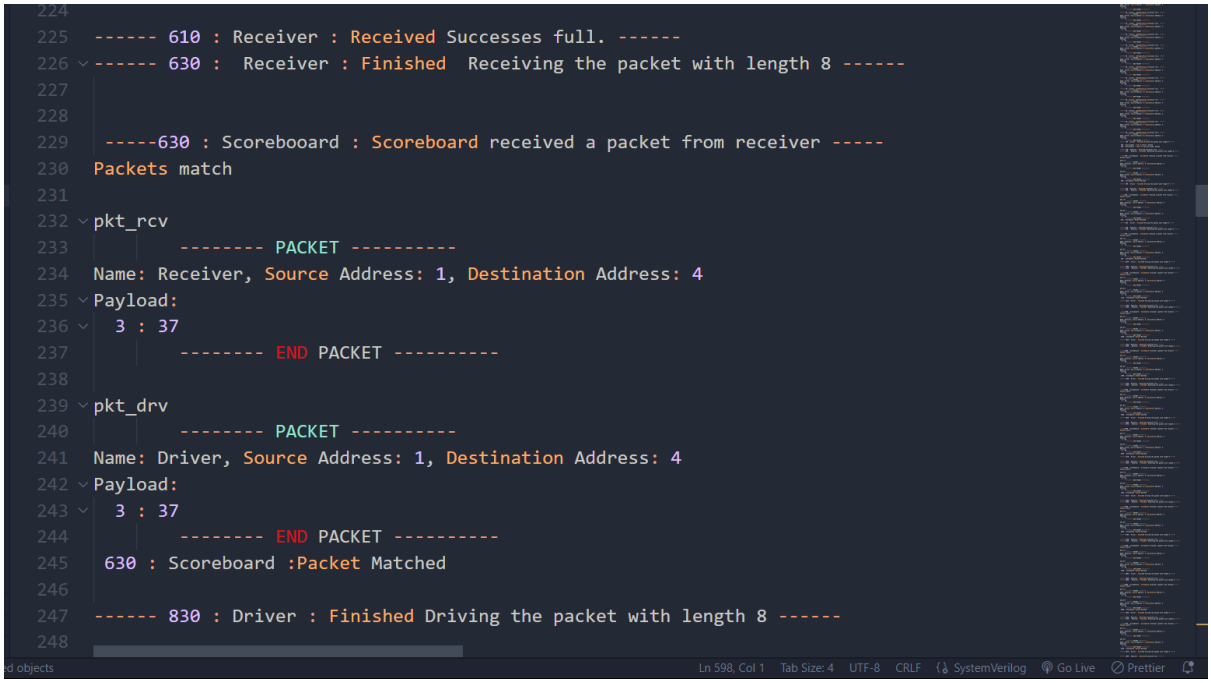
Sim Time: 20 us

- **Kết quả gửi lên Score board :**

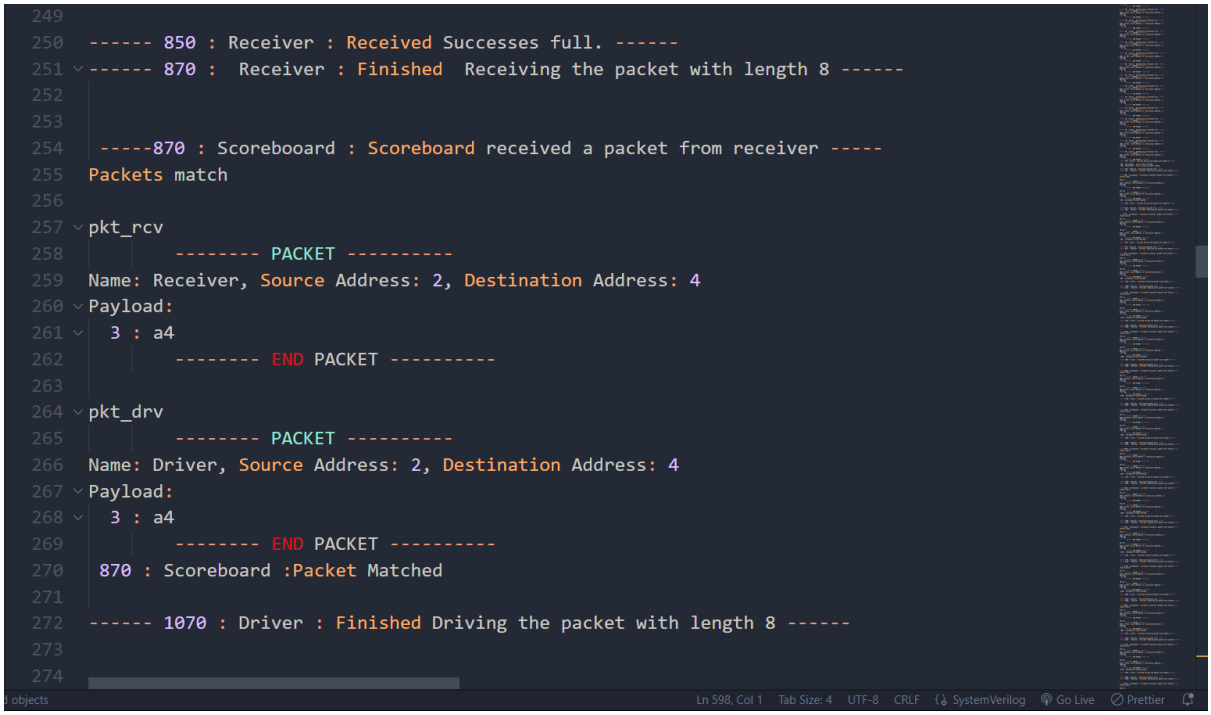
+ Với port 0 với data d7



+ Với port 1 với data 37:



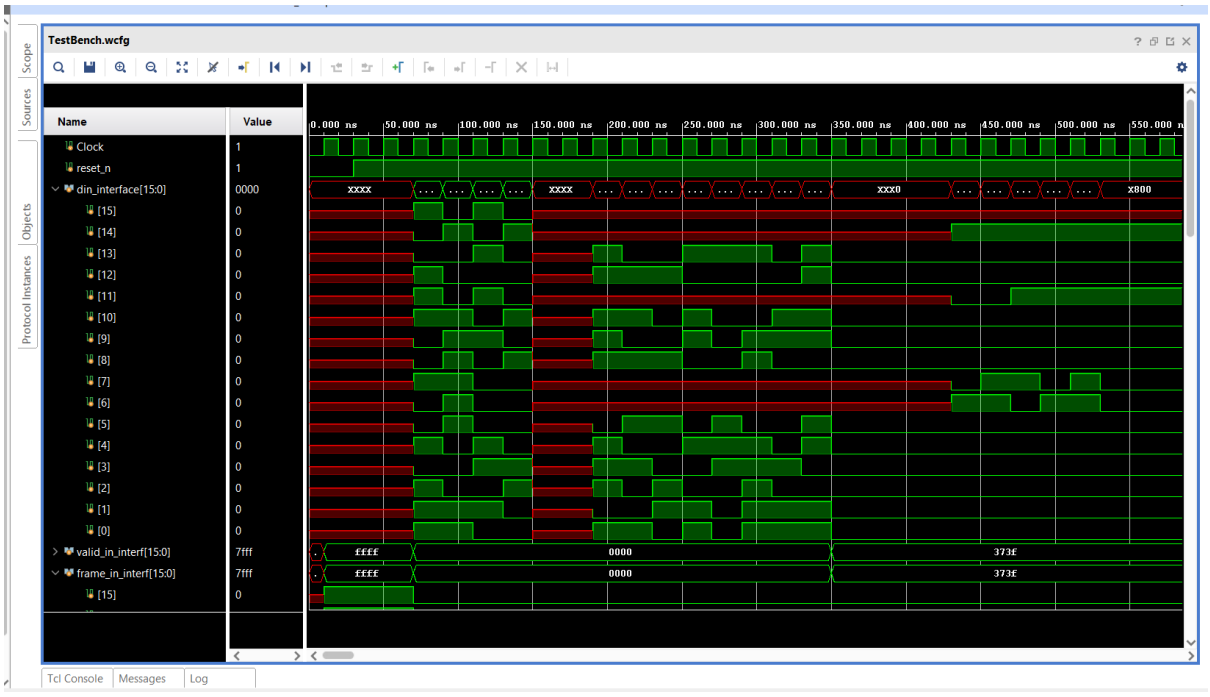
+ Với port 2 với data a4:

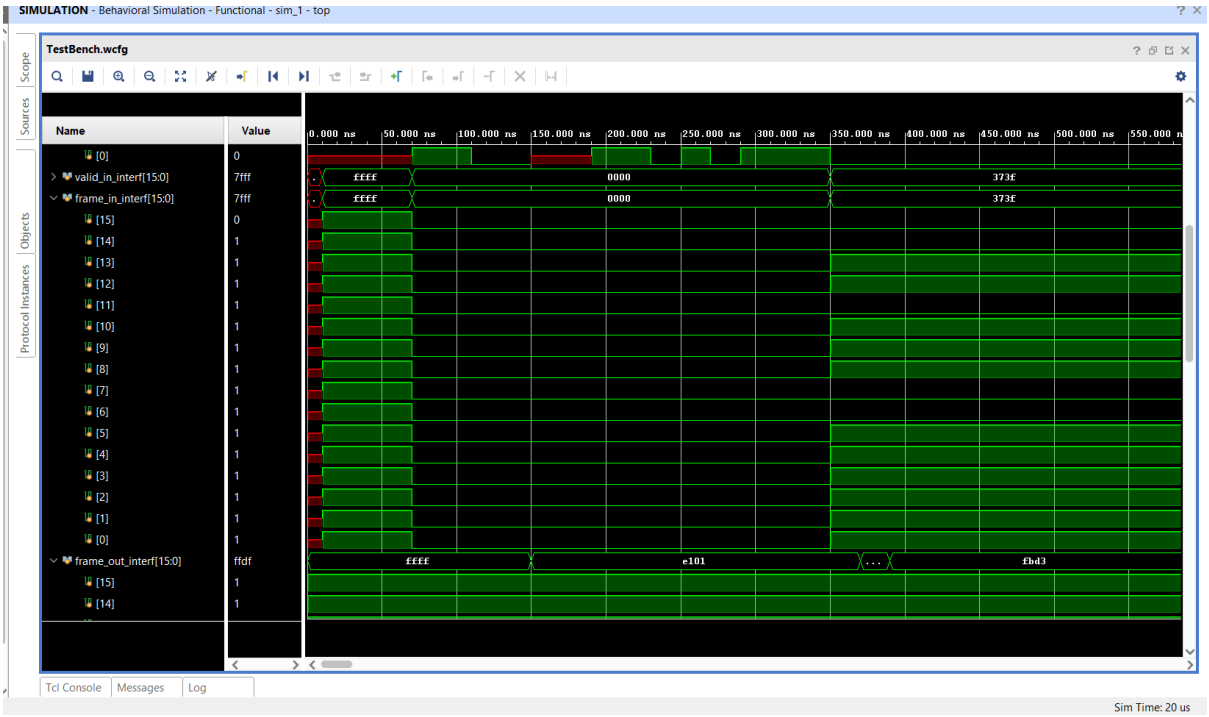


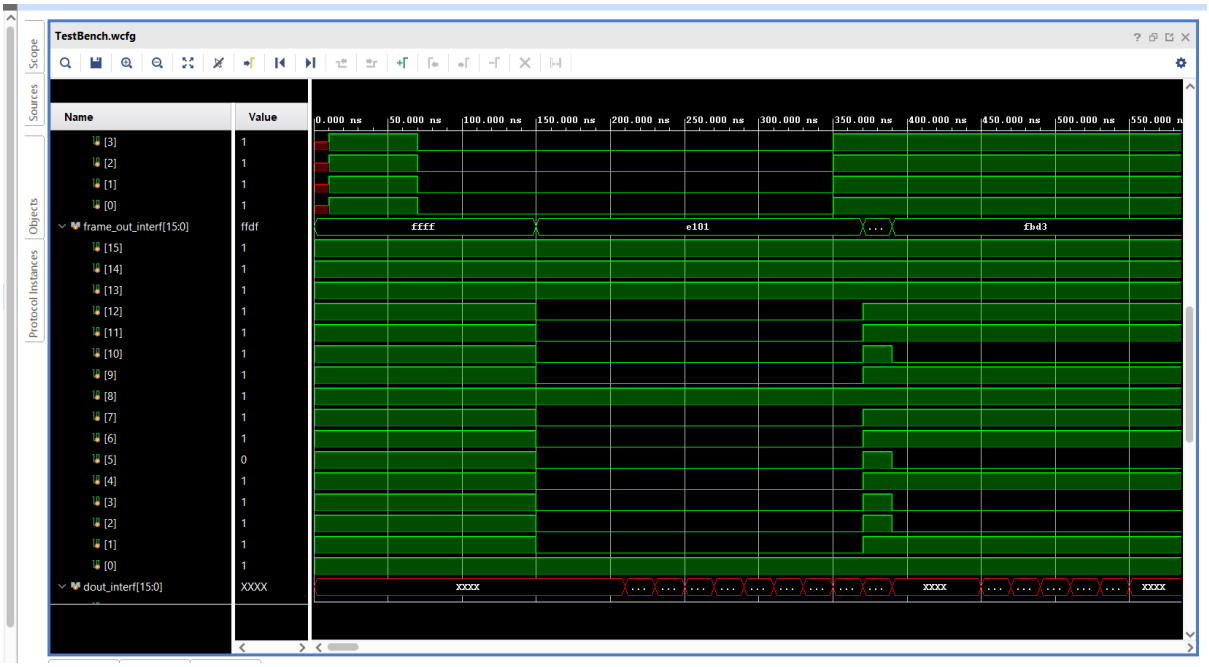
2. Trường hợp 1: test 16 port in cùng truy suất ra ngẫu nhiên ra 16 port out

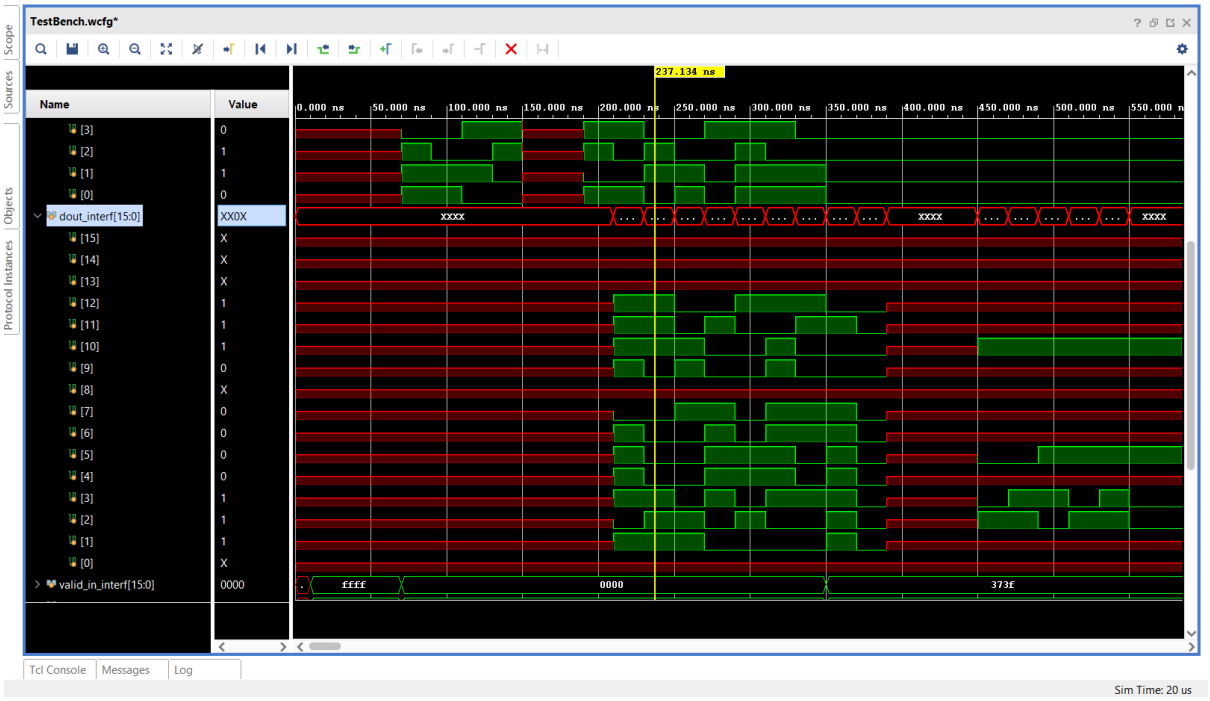
```
TestBench > Enviroment.sv > Environment > build
 7  class Environment;
31      function void build();
32          $display(" %0d : Environment : start of build() method",$time);
33
34              rcvr2sb = new();
35              drvr2sb = new();
36
37              // for (int i = 0; i < 16; i++) begin
38              //     randomize(da);
39              //     driver[i] = new(input_intf, drvr2sb, i, 4);
40              //     receiver[i] = new(output_intf, rcvr2sb, i, 4);
41              // end
42
43
44              for(int i = 0; i < 16; i++) begin
45                  randomize(da);
46                  driver[i]= new(input_intf, drvr2sb, i, da);
47                  receiver[i]= new(output_intf, rcvr2sb, i, da);
48
49              end
50
51              sb = new(drvr2sb,rcvr2sb);
52
53          $display(" %0d : Environment : end of build() method",$time);
54      endfunction :build
55
```

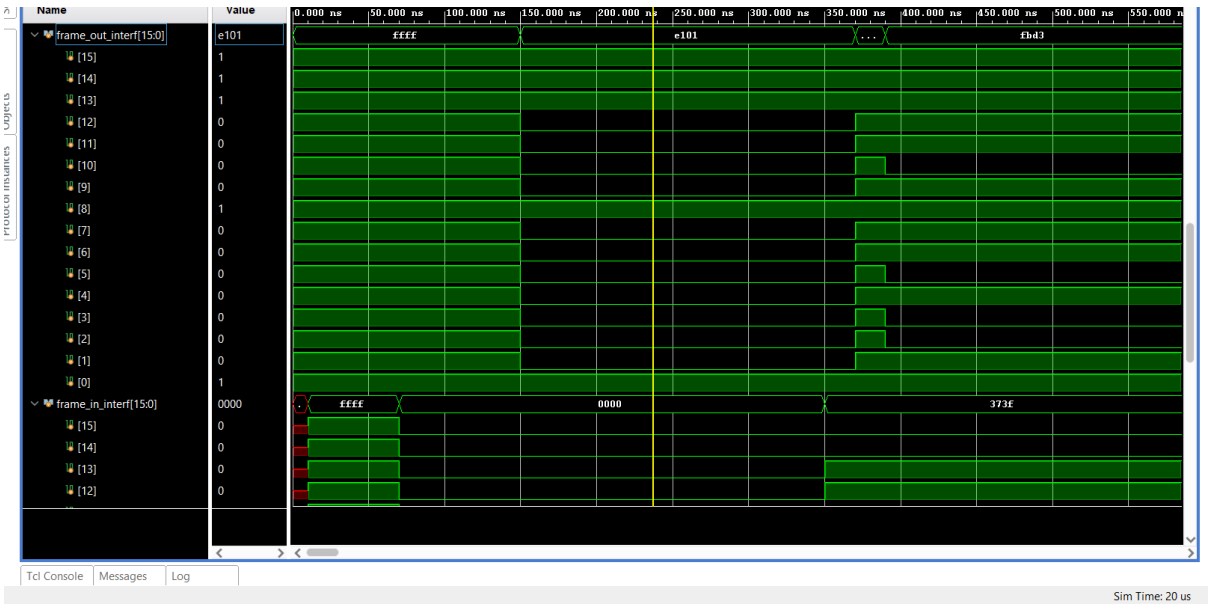
Test bench :




SIMULATION - Behavioral Simulation - Functional - sim_1 - top
TestBench.wcfg
Scope
Sources
Objects
Protocol Instances
Name
Value
[0]
valid_in_interf[15:0]
frame_in_interf[15:0]
[15]
[14]
[13]
[12]
[11]
[10]
[9]
[8]
[7]
[6]
[5]
[4]
[3]
[2]
[1]
[0]
frame_out_interf[15:0]
[15]
[14]
0
7fff
7fff
0
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1
ffdf
1
1
0.000 ns
50.000 ns
100.000 ns
150.000 ns
200.000 ns
250.000 ns
300.000 ns
350.000 ns
400.000 ns
450.000 ns
500.000 ns
550.000 n
ffff
0000
373f
e101
fbd3
Tcl Console
Messages
Log
Sim Time: 20 us


TestBench.wcfg
Scope
Sources
Objects
Protocol Instances
Name
Value
[3]
[2]
[1]
[0]
frame_out_interf[15:0]
[15]
[14]
[13]
[12]
[11]
[10]
[9]
[8]
[7]
[6]
[5]
[4]
[3]
[2]
[1]
[0]
dout_interf[15:0]
1
1
1
1
ffdf
1
1
1
1
1
1
1
1
1
1
0
1
1
1
1
1
XXXX
0.000 ns
50.000 ns
100.000 ns
150.000 ns
200.000 ns
250.000 ns
300.000 ns
350.000 ns
400.000 ns
450.000 ns
500.000 ns
550.000 n
ffff
e101
fbd3
xxxx





- **Nhận xét :** DUT vẫn hoạt động bình thường nhưng Receiver bị lỗi chỉ nhận được của port in [0] :


Tcl Console
Messages
Log
Name: Receiver, Source Address: 0, Destination Address: 3
Payload:
3 : d7
-------- END PACKET ----------
pkt_drv
-------- PACKET ----------
Name: Driver, Source Address: 0, Destination Address: 3
Payload:
3 : d7
-------- END PACKET ----------
390 : Scoreboard :Packet Matched
------ 590 : Driver : Finished Driving the packet with length 8 ------
------ 590 : Driver : Finished Driving the packet with length 8 ------
------ 590 : Driver : Finished Driving the packet with length 8 ------
------ 590 : Driver : Finished Driving the packet with length 8 ------
------ 830 : Driver : Finished Driving the packet with length 8 ------
INFO: [USF-XSim-96] XSim completed. Design snapshot 'top_behav' loaded.
INFO: [USF-XSim-97] XSim simulation ran for 20us
launch_simulation: Time (s): cpu = 00:00:01 ; elapsed = 00:00:09 . Memory (MB): peak = 2604.617 ; gain = 0.000
Type a Tcl command here

--- Hết ---