VLSI ARCHITECTURES:
ASSIGNMENT 4:

1. Design and simulate an 8 bit X 8 bit array multiplier using TSMC 180nm CMOS process. Estimate its area, delay and power dissipation.

Ans:

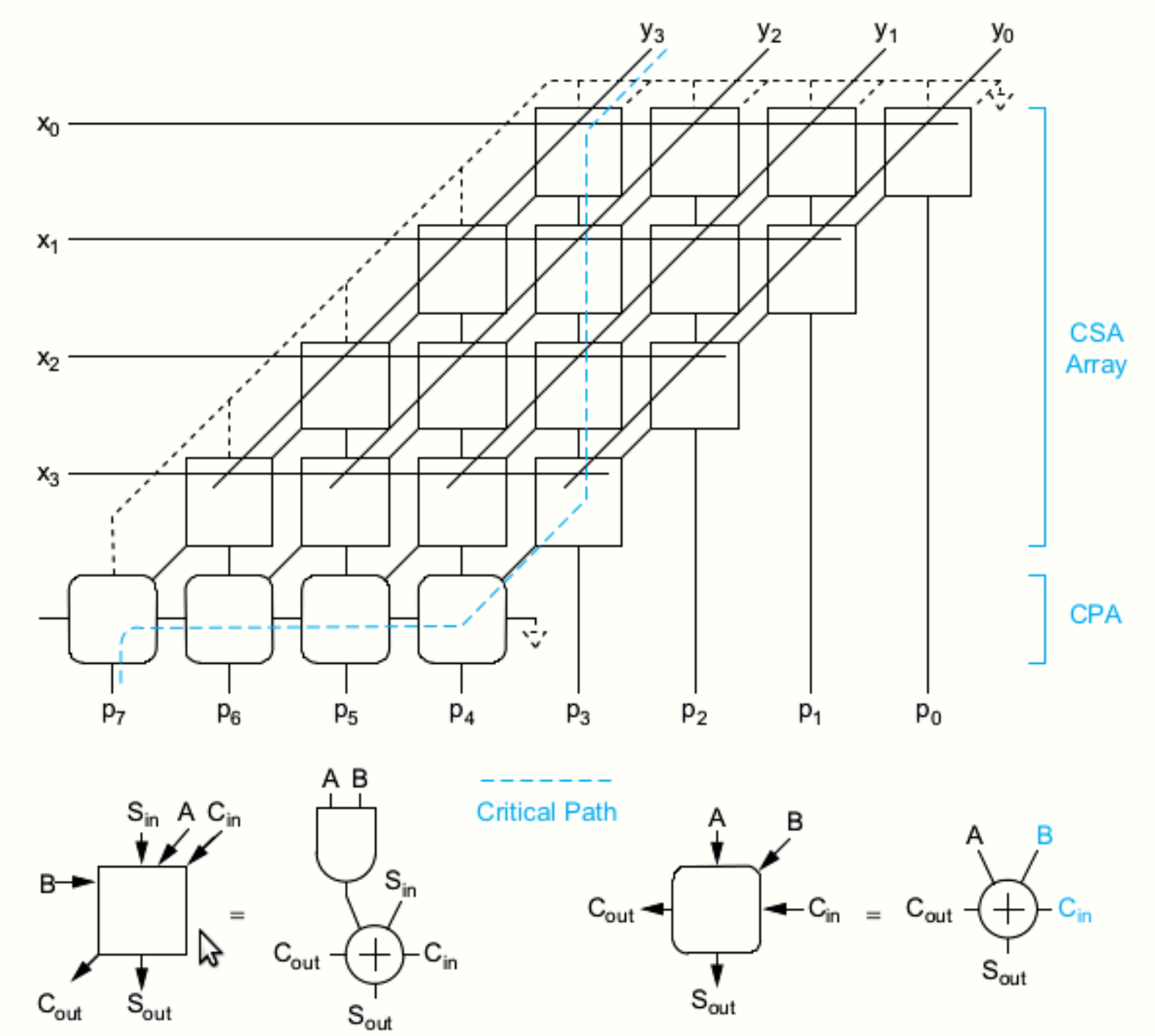


fig: Array multiplier block daigram

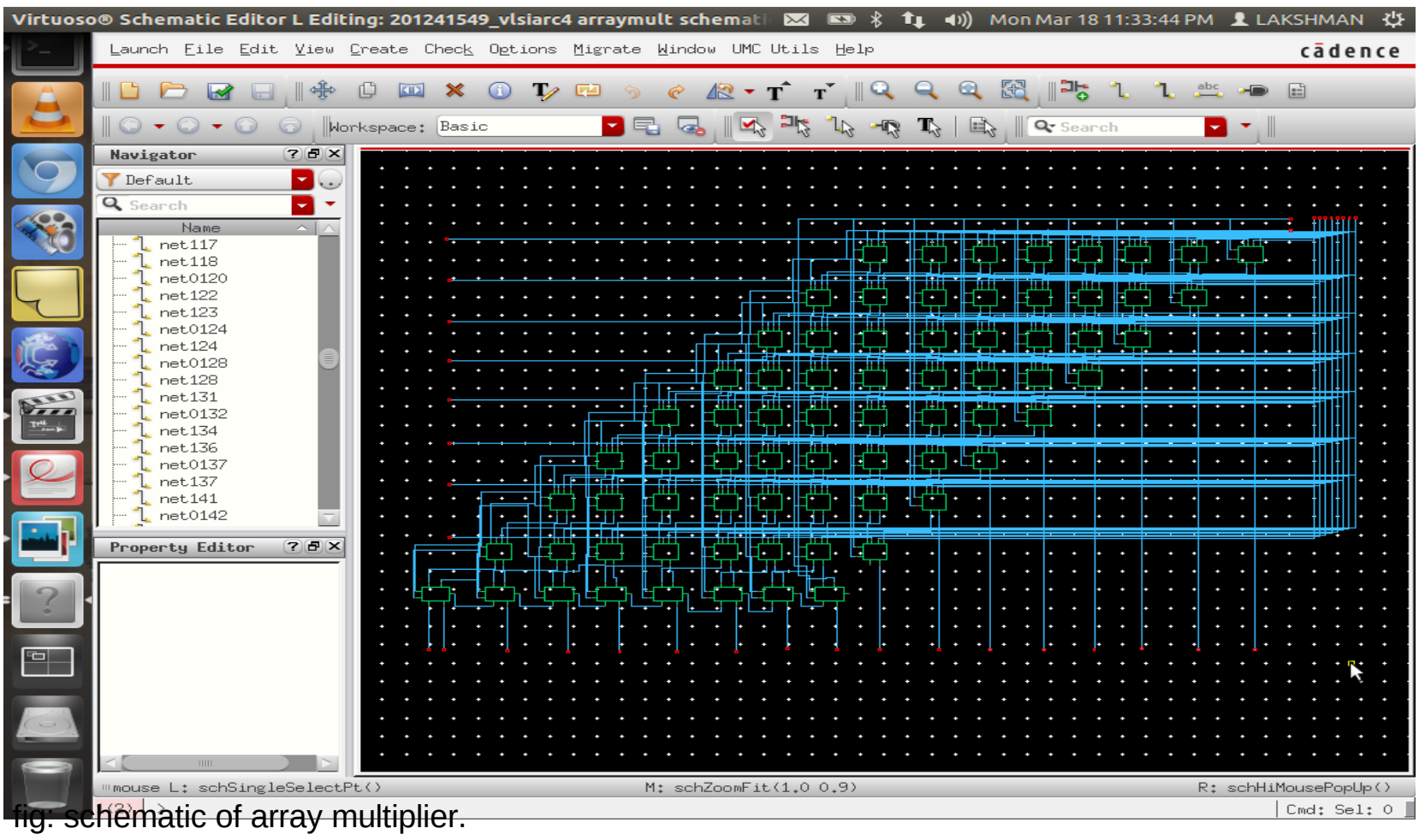
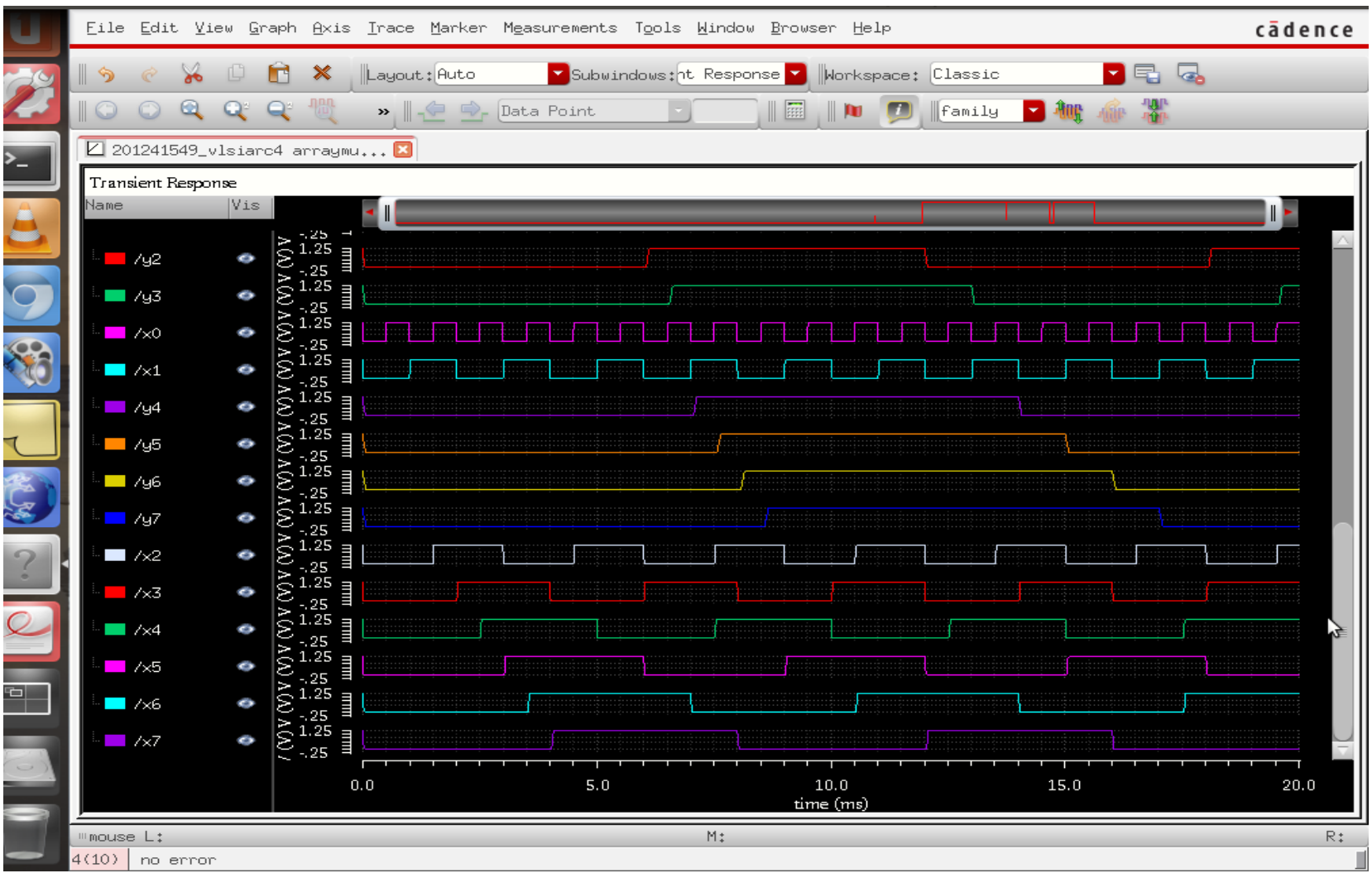
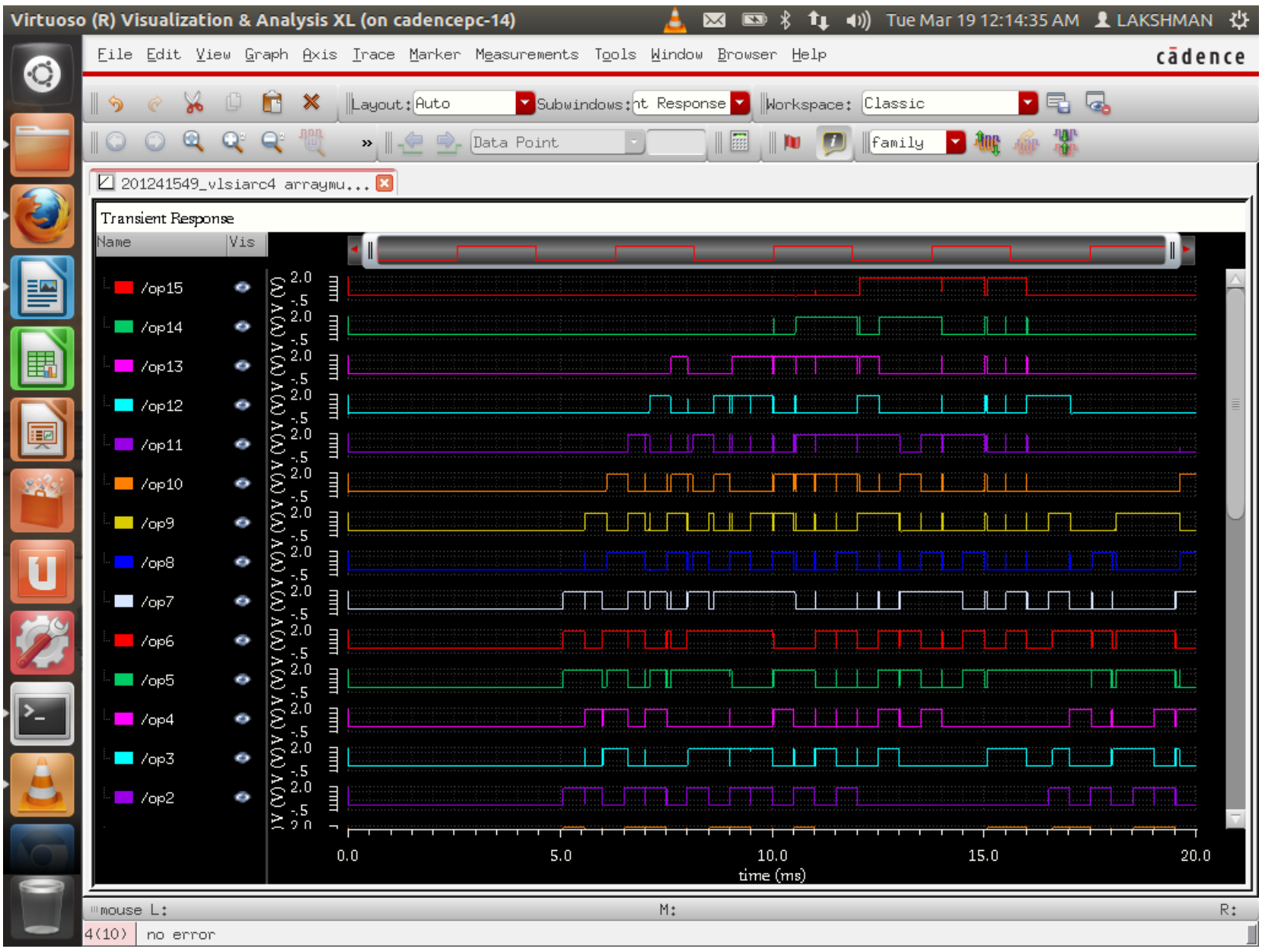


fig: schematic of array multiplier.

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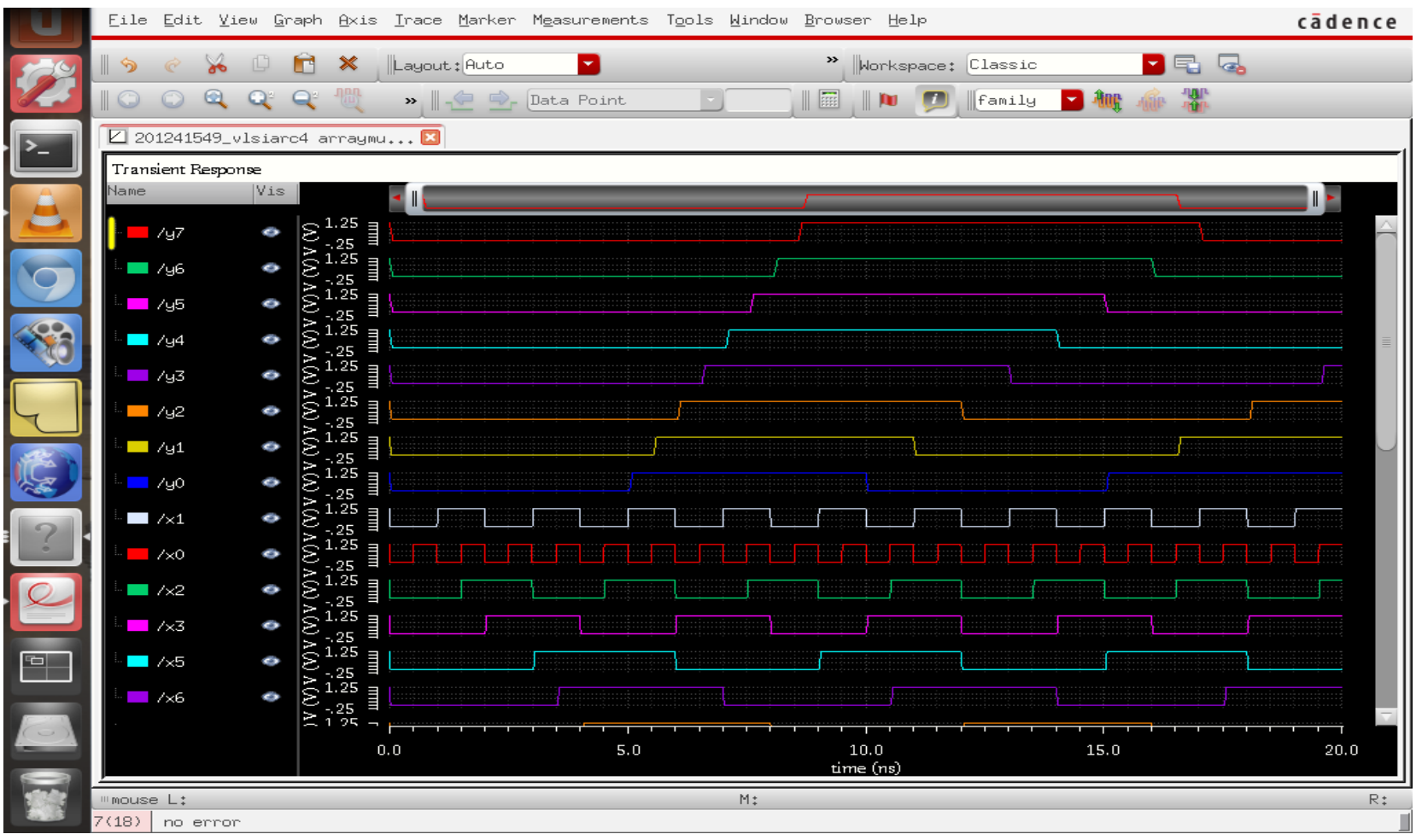
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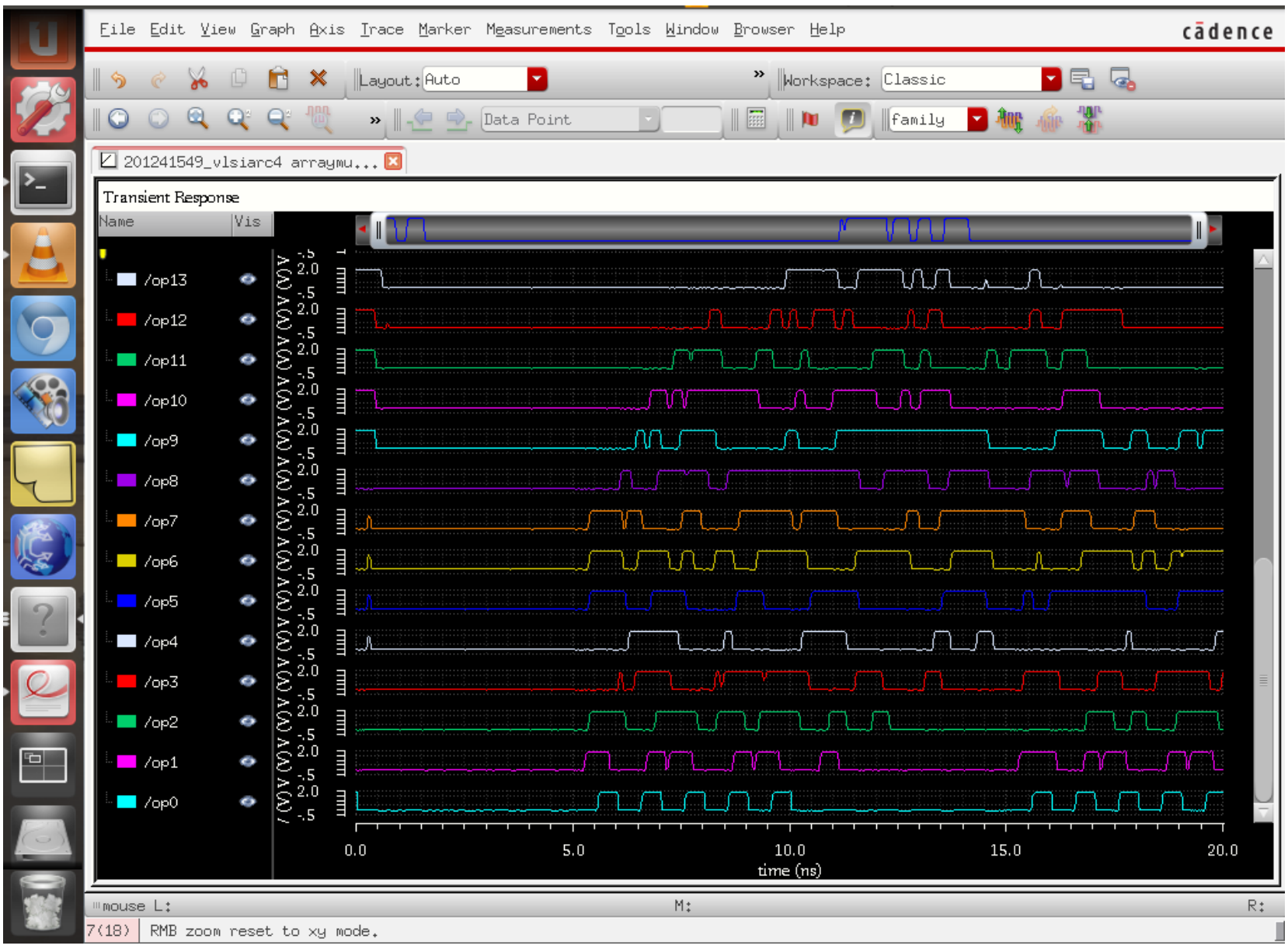


Fig: output wavefoms.

2. Consider the 8 bit multiplicand and multipliers in the previous problem to be signed binary numbers.Implement the multiplier based on Booth's algorithm using

a. cascaded linear sequence of carry save adders.

b. optimized Wallace tree adders

Compare the performances of the two multipliers in terms of area, speed and power dissipation

Ans:

fig:booth Encoder and booth selector.

x_{i+2}	x_{i+1}	x_i	x_{i-1}	Partial Product
0	0	0	0	0
0	0	0	1	Y
0	0	1	0	Y
0	0	1	1	$2Y$
0	1	0	0	$2Y$
0	1	0	1	$3Y$
0	1	1	0	$3Y$
0	1	1	1	$4Y$
1	0	0	0	$-4Y$
1	0	0	1	$-3Y$
1	0	1	0	$-3Y$
1	0	1	1	$-2Y$
1	1	0	0	$-2Y$
1	1	0	1	$-Y$
1	1	1	0	$-Y$
1	1	1	1	-0

Fig: booth encoding table.

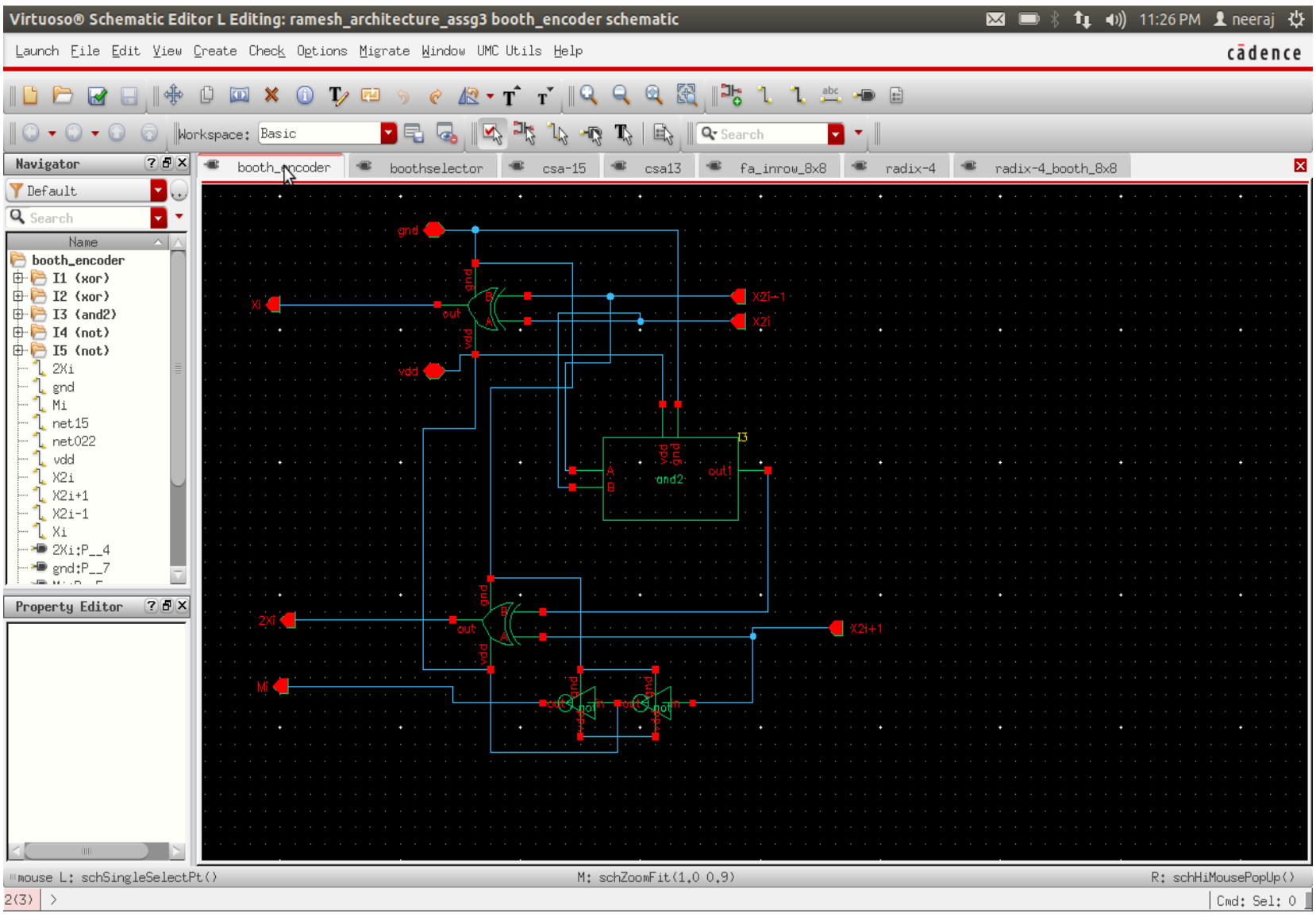


Fig: booth Encoder.

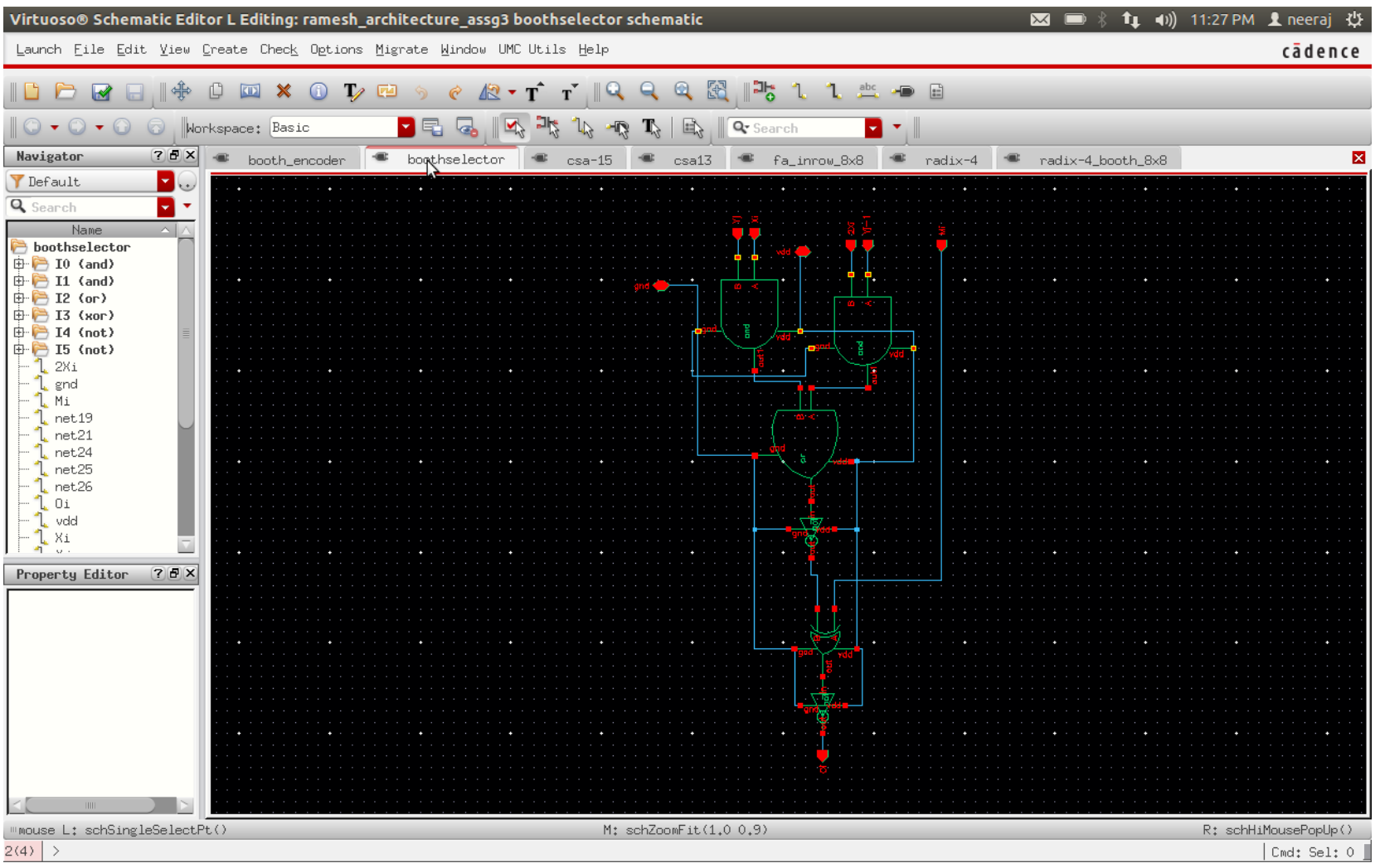


Fig:booth selector

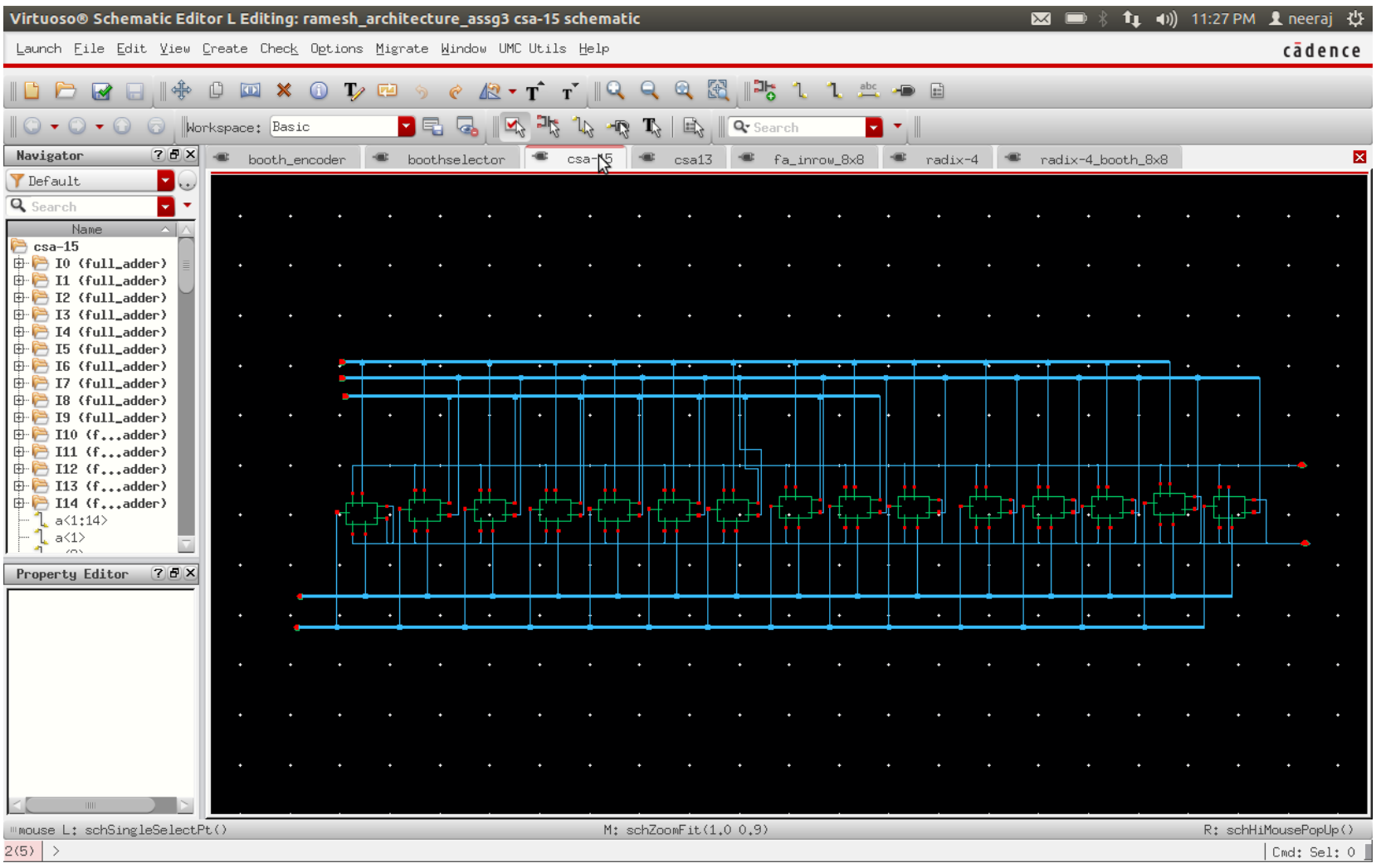


fig: 15 bit cay save adder

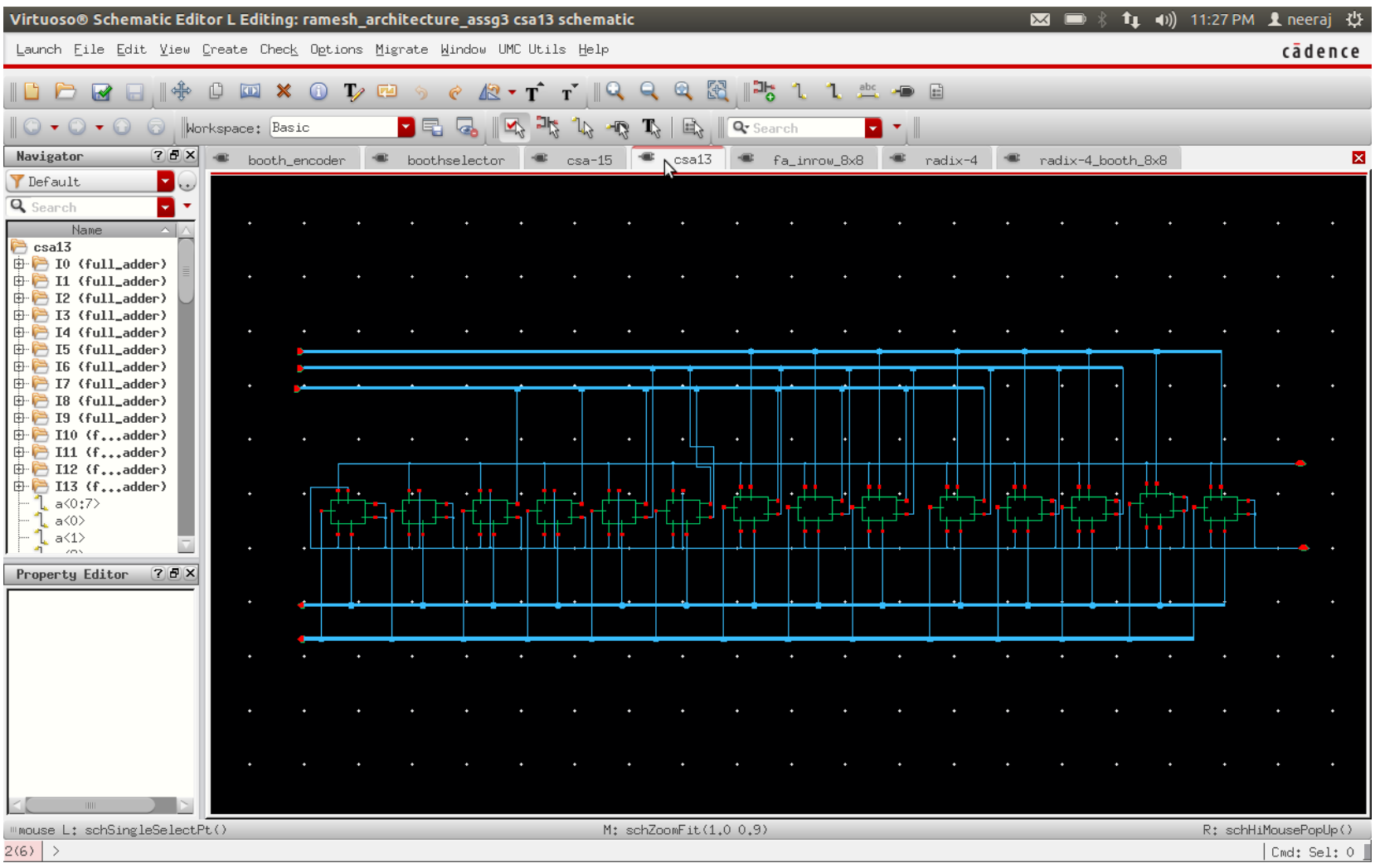


fig: carry save adder 14-bit.

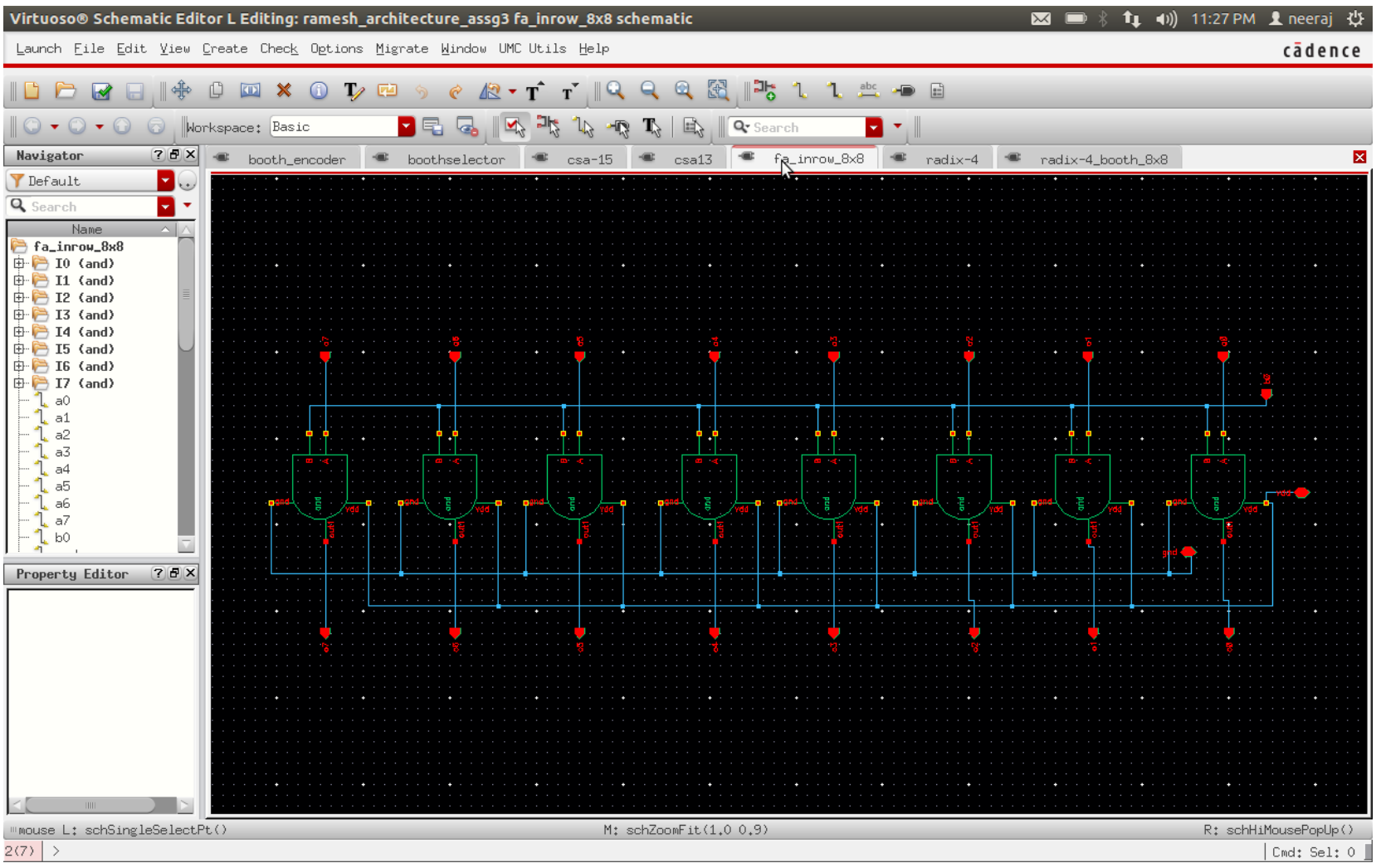
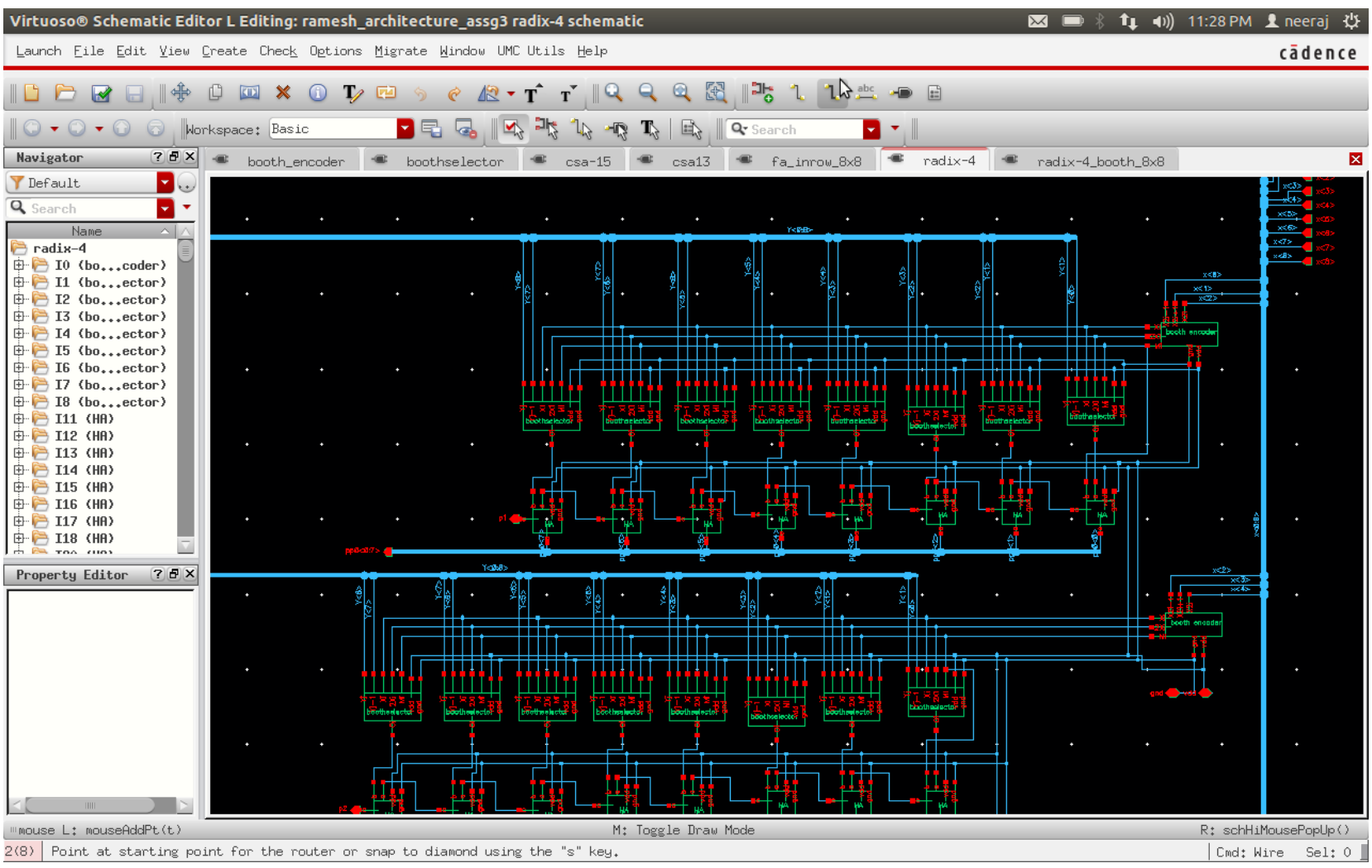


Fig: 8-bit carry save adders.



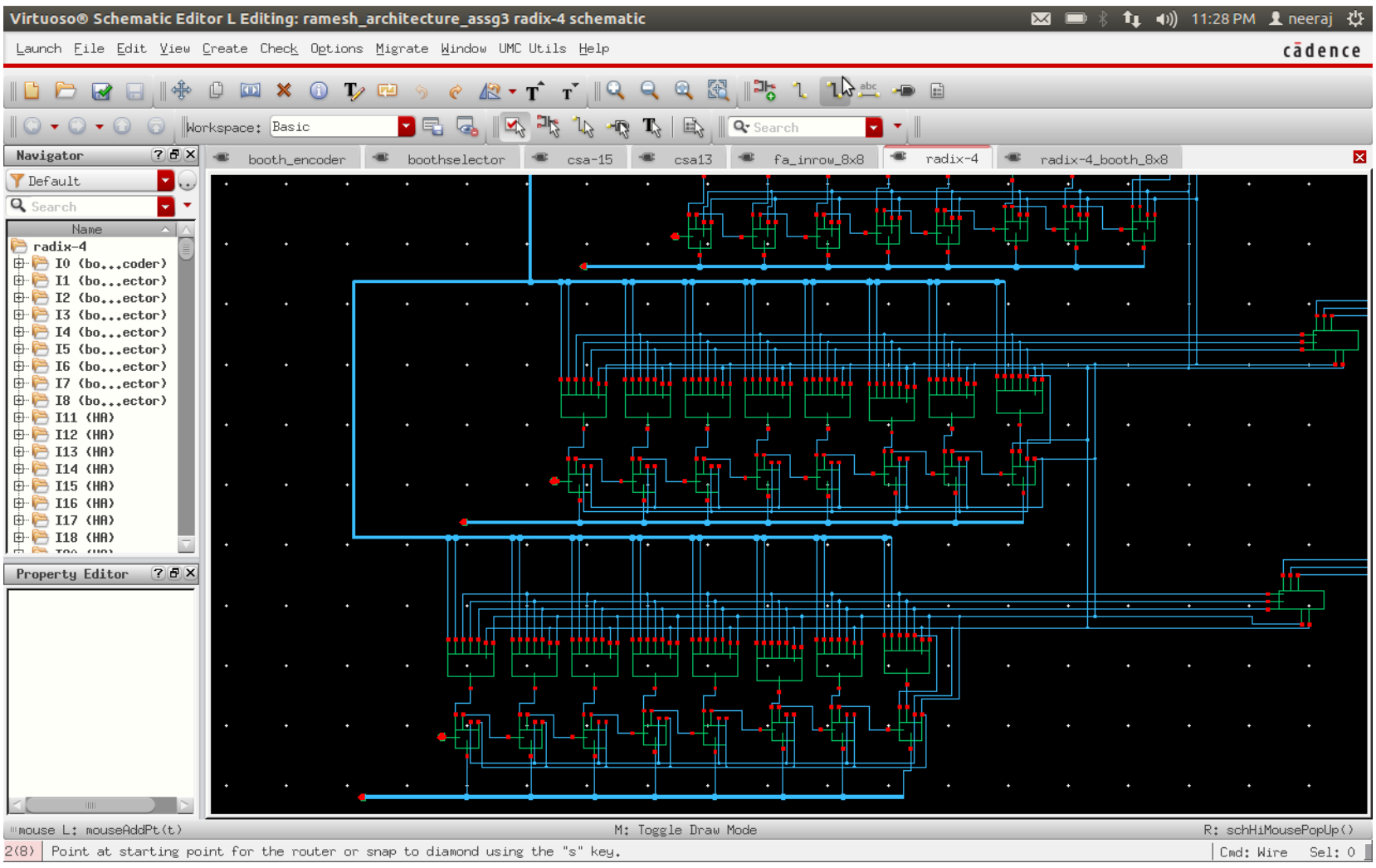


Fig: radix-4 booth multiplier.

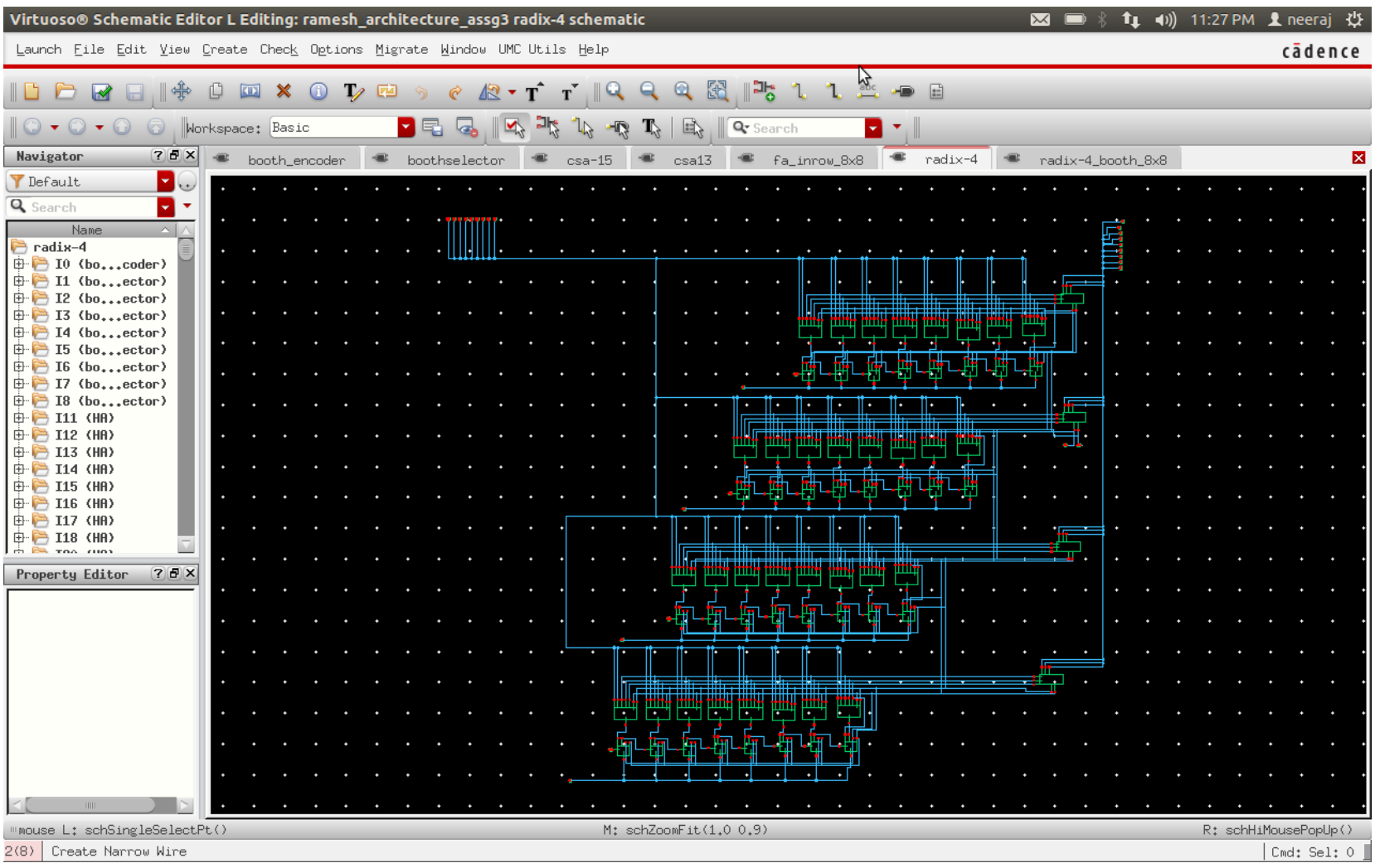
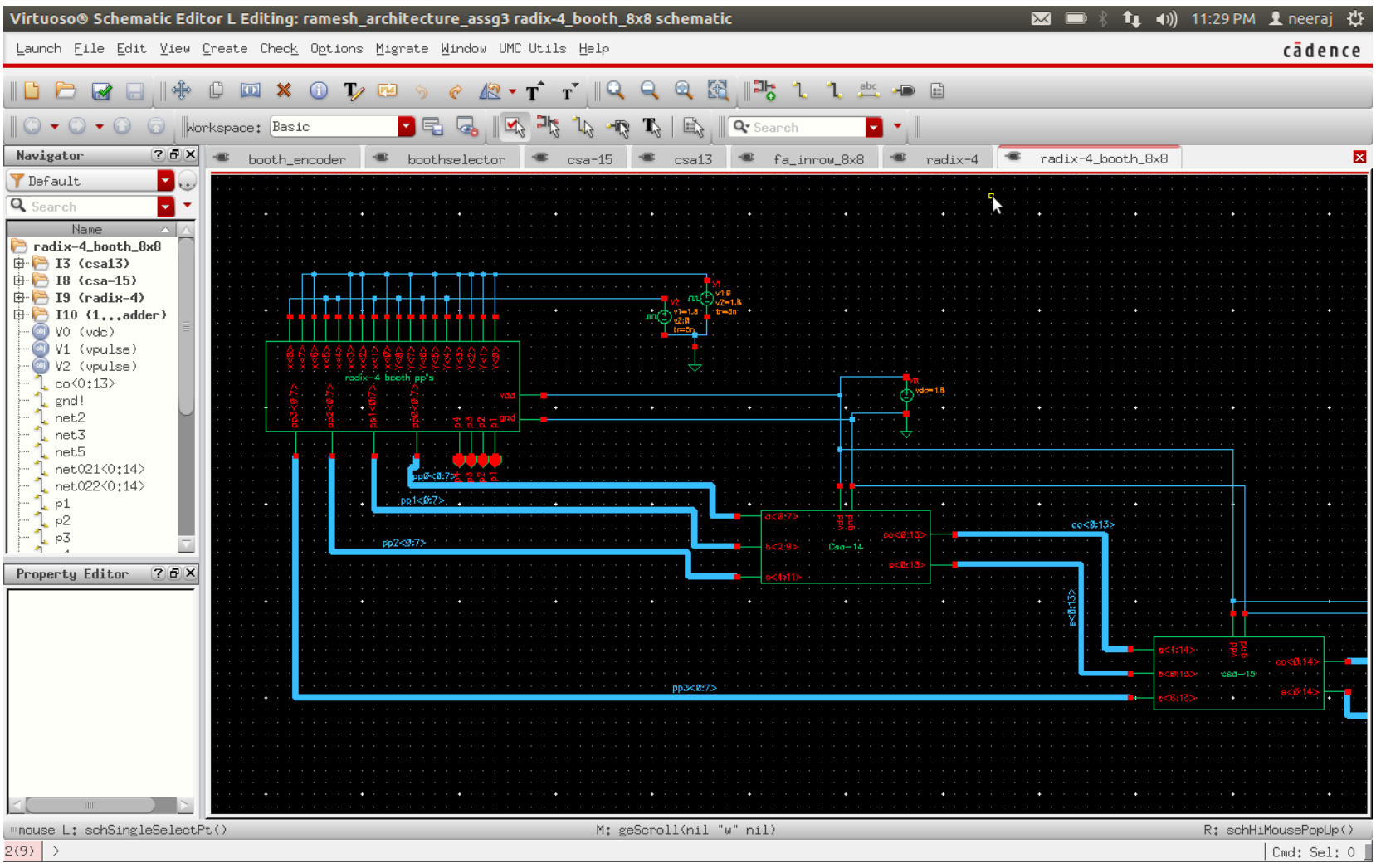


Fig:radix booth multiplier.



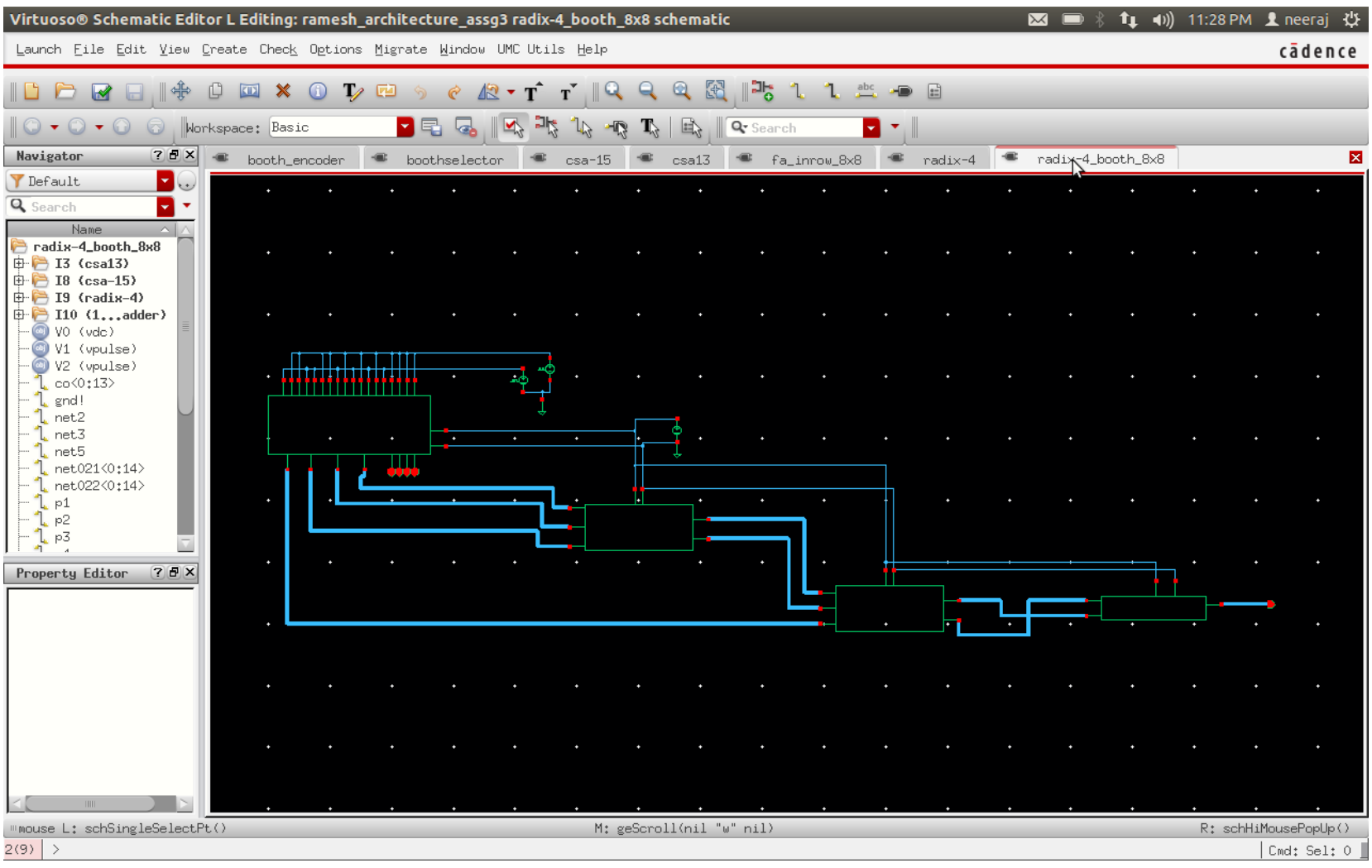
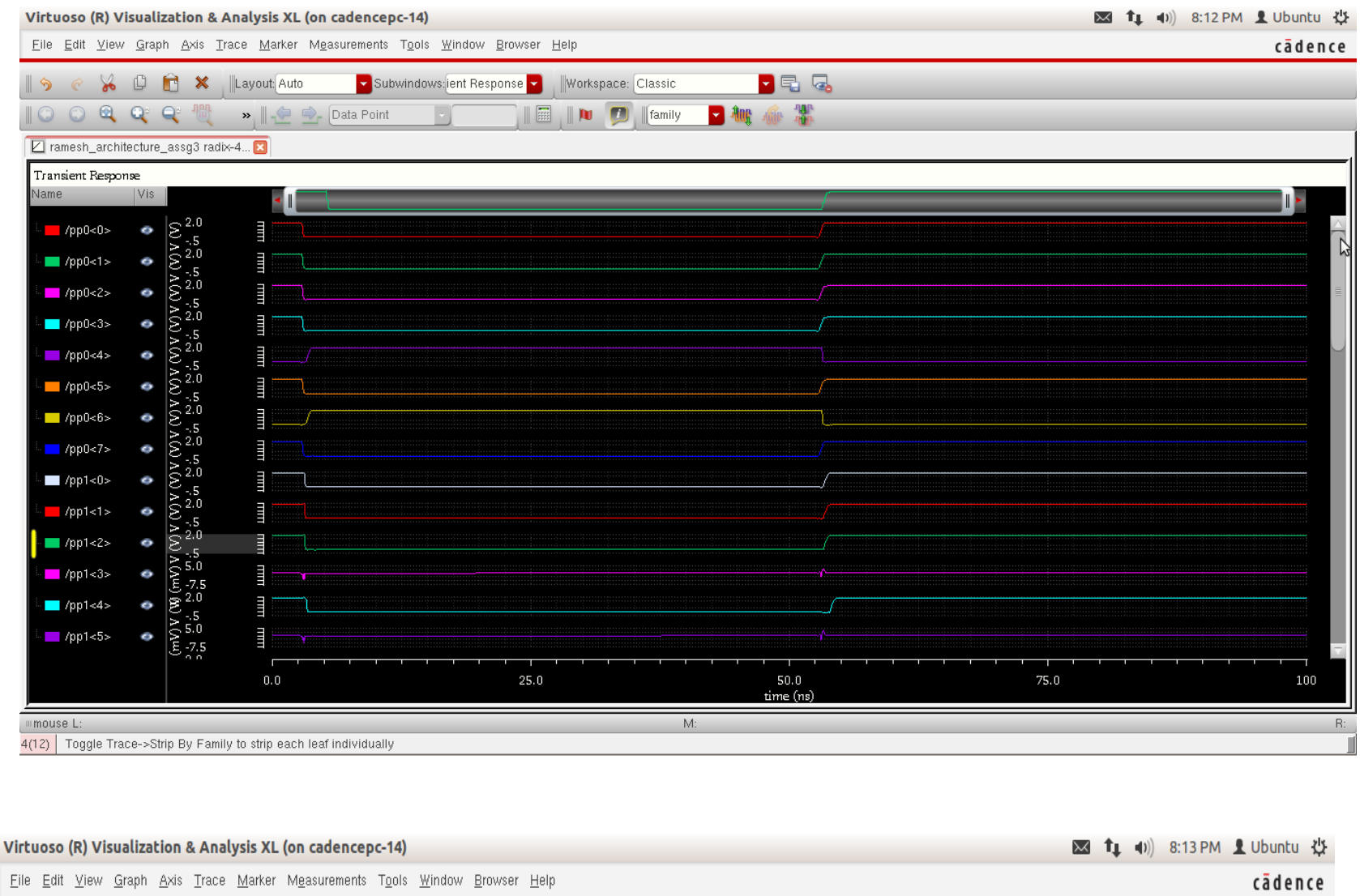


Fig: 8x8 radix booth multiplier.



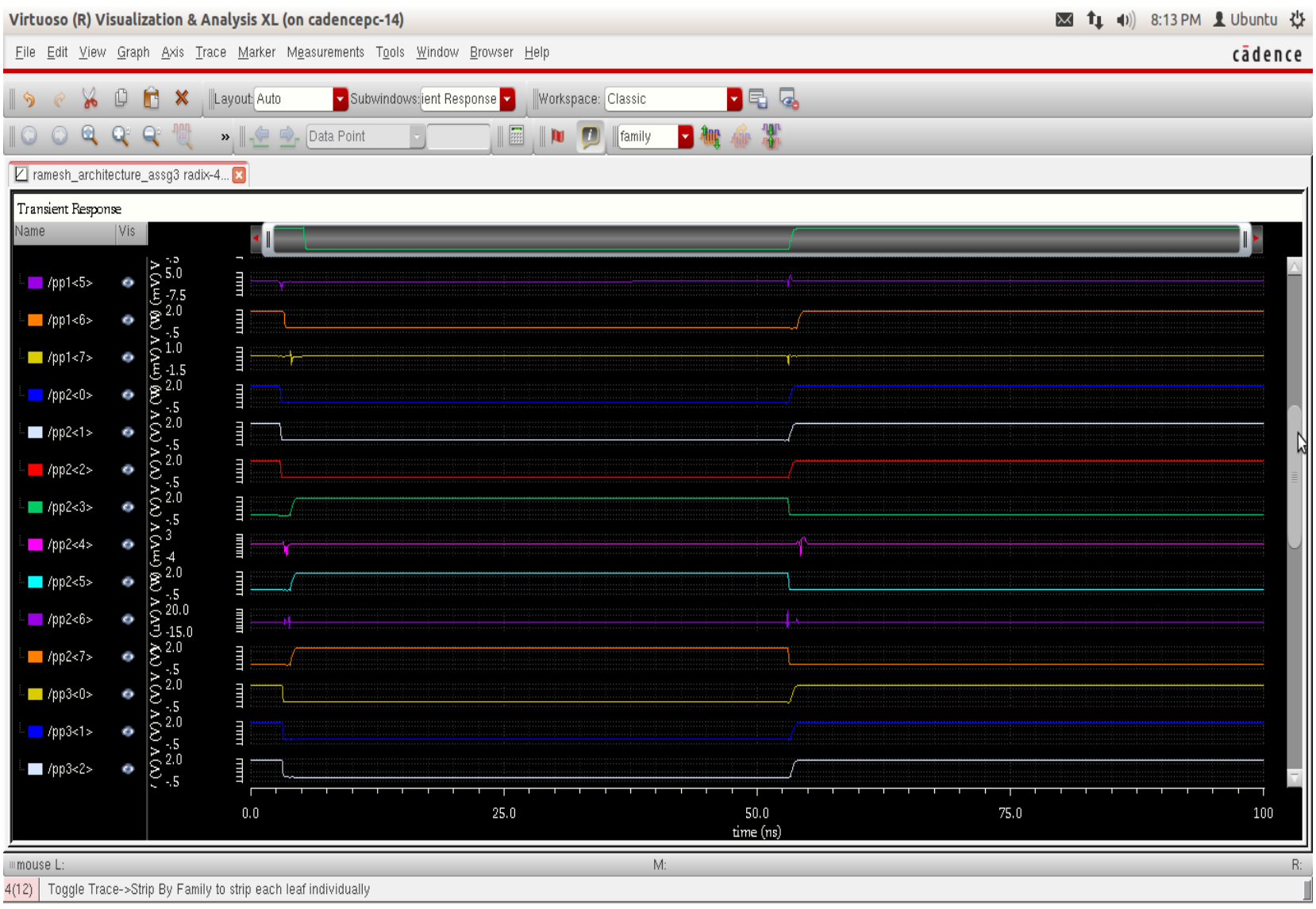


Fig:output waveform.

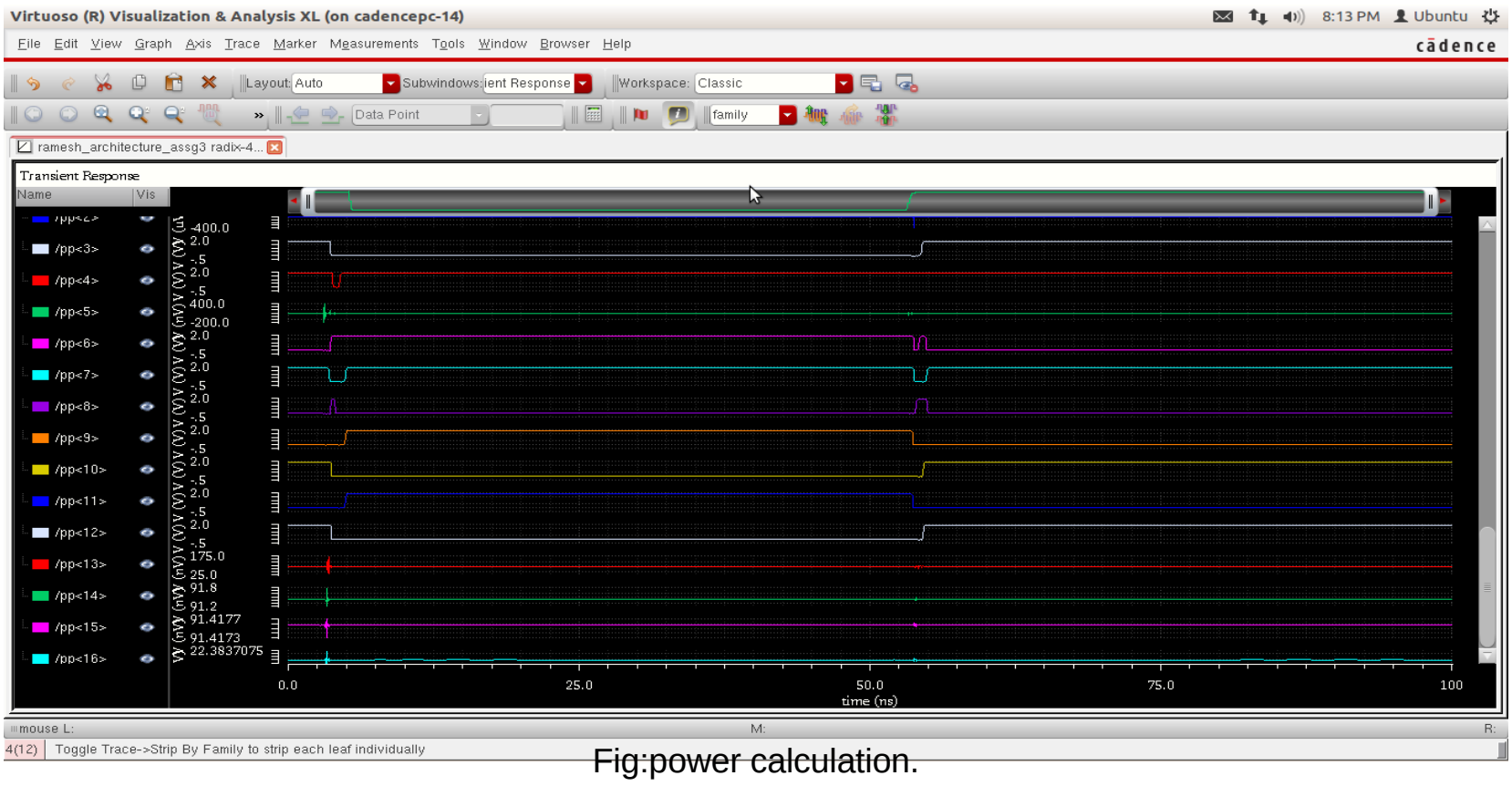


Fig:power calculation.

power=(Iavg*Vdd)/T=(-76.75x10^-12*1.8)/200n = 690 mW.