

From the delay comparison of adders, it is clear that KSA, a representative of parallel prefix adders, is the fastest. The delay performance of CLA is at par RCA for 4-bit and 8-bit operands but as the number of bits increases, the parallelism of CLA proves to be advantageous and its delay reduces when compared to RCA. For 4-bit and 8-bit adders, the logic delay is same for all the adders but KSA is offering less delay due to improved routing, whereas for 16-bit operands, KSA is advantageous in logic as well as routing.

Table 2 describes the area utilization of each design in terms of slices and LUTs, and also the IOBs used by the adder has been given. The area comparison in terms of number of slices has been plotted in figure 9. KSA was the best when considered for delay but for area, as the number of bits of operands increases KSA occupies more area due to increase in parallel prefix stages.

Table 2: Comparison of Area of Adders

Type of Adder	Area		
	No. of Slices used (out of 3584)	No. of 4-input LUTs used (out of 7168)	No. of Bonded IOBs used (out of 141)
4-bit RCA	4	8	14
4-bit CLA	4	8	14
4-bit KSA	4	8	14
8-bit RCA	9	16	26
8-bit CLA	9	16	26
8-bit KSA	9	16	26
16-bit RCA	18	32	50
16-bit CLA	18	32	50
16-bit KSA	37	64	50

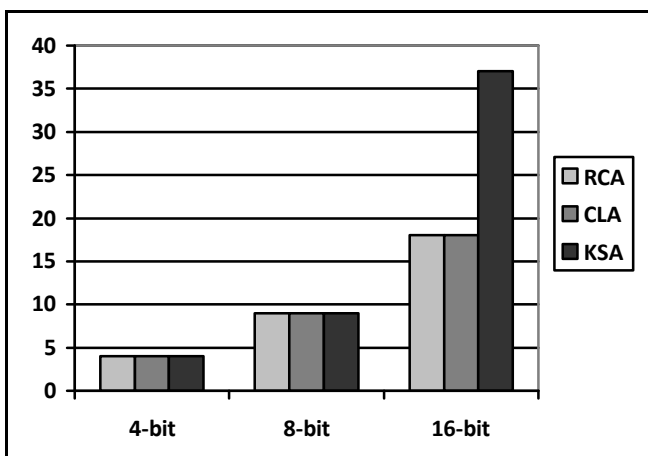


Figure 9: Graphical Representation of the Number of Slices Utilized by the Adders

It can be seen that for 4-bit and 8-bit operands, the area of all the three adders are equal, but for 16-bit value KSA shows tremendous increase in area. Hence, from area point of view, RCA and CLA are better than KSA.

5. Conclusion

The above discussion can be summarized as; KSA has the best delay performance whereas RCA and CLA offer a better area profile.

From the comparison of delay and area of various adders for different number of bits, we can derive a conclusion that speed and area cannot be optimized at the same time. If one parameter is improved, the other definitely shows degradation.

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