

# DESC: Energy-Efficient Data Exchange using Synchronized Counters

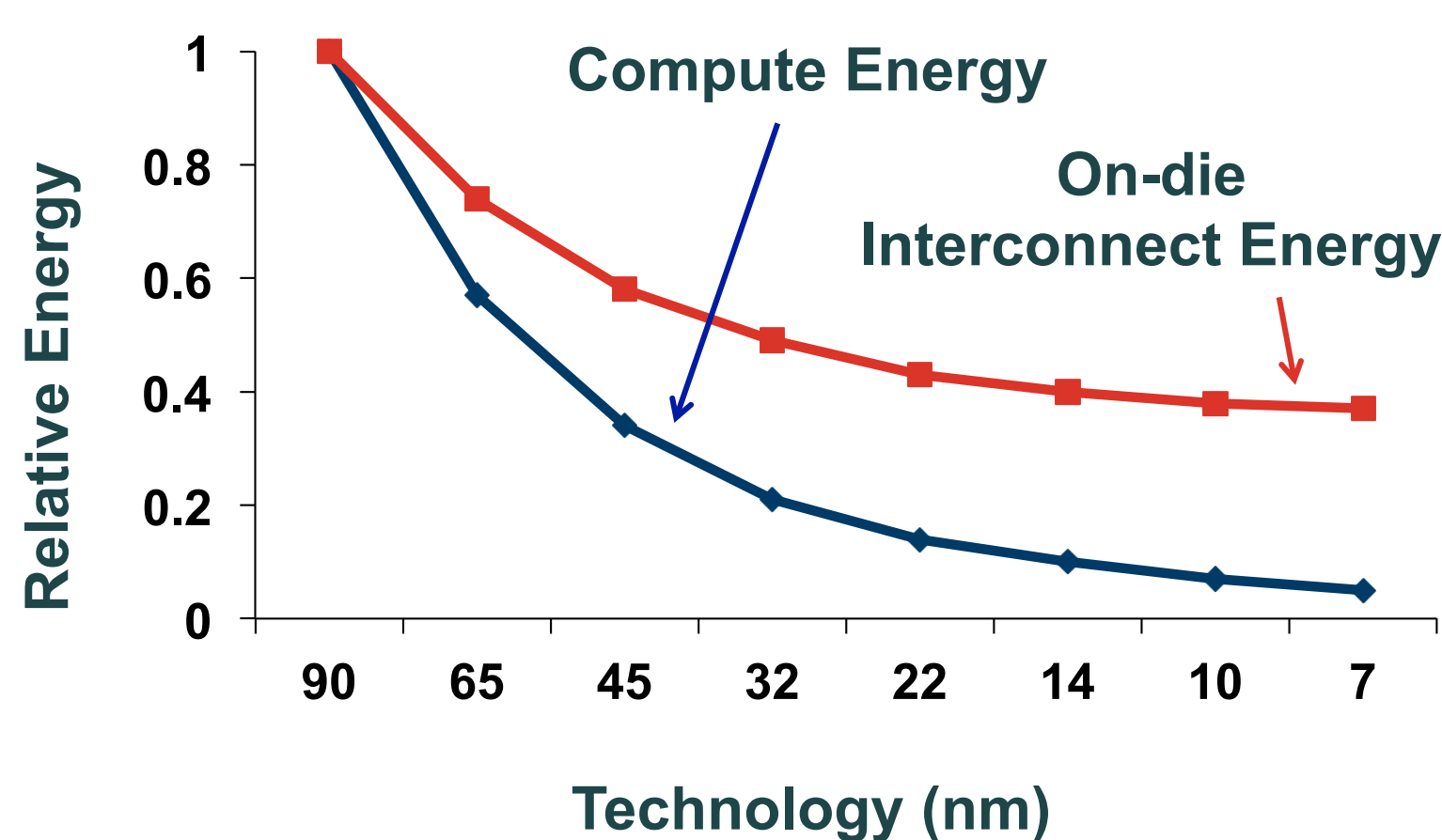
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## Motivation

- A significant and growing fraction of on-die energy is spent in data movement.

Shekhar Borkar, *Journal of Lightwave Technology*, 2013

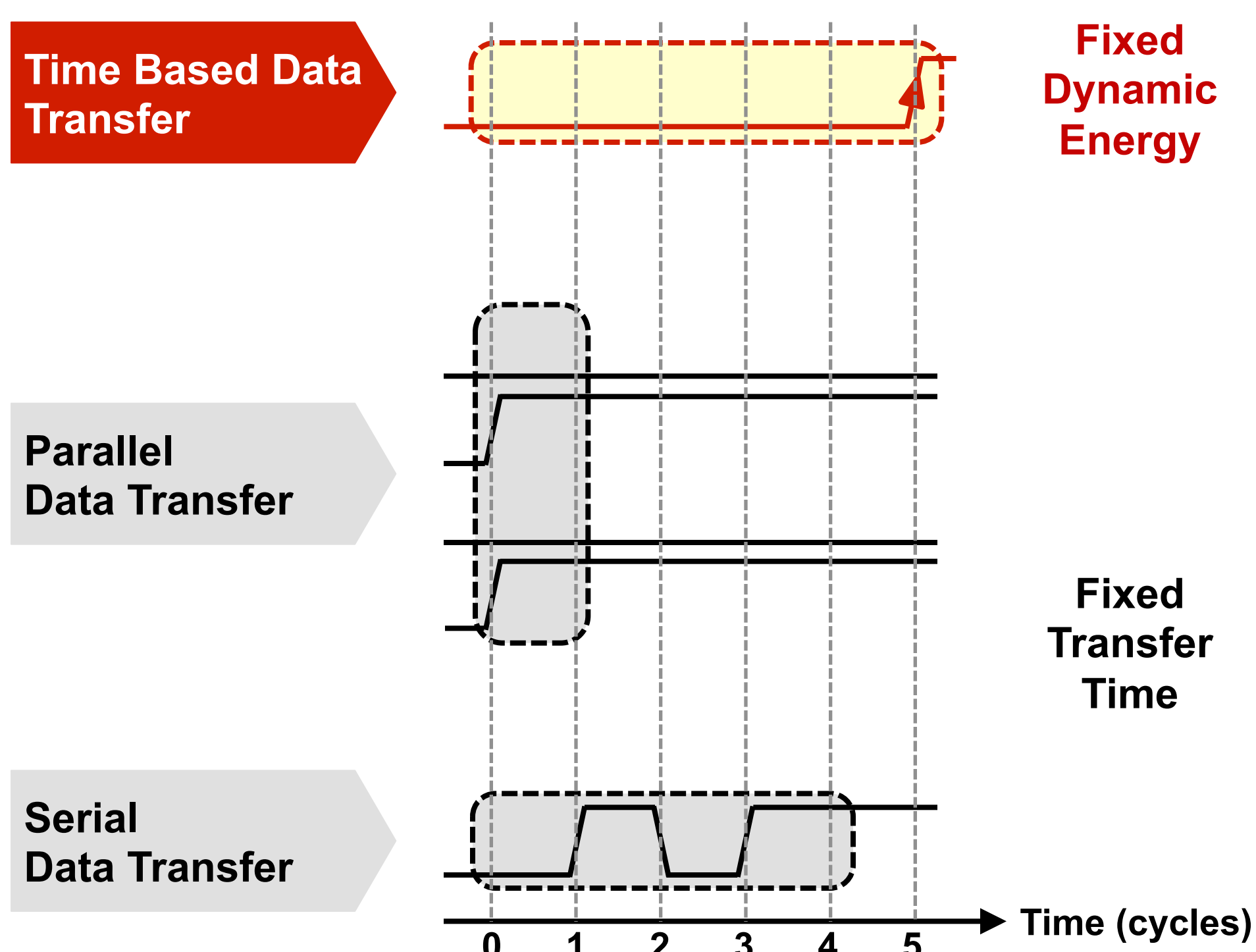


- Long, capacitive interconnects consume most of the LLC access energy.

## Key Idea

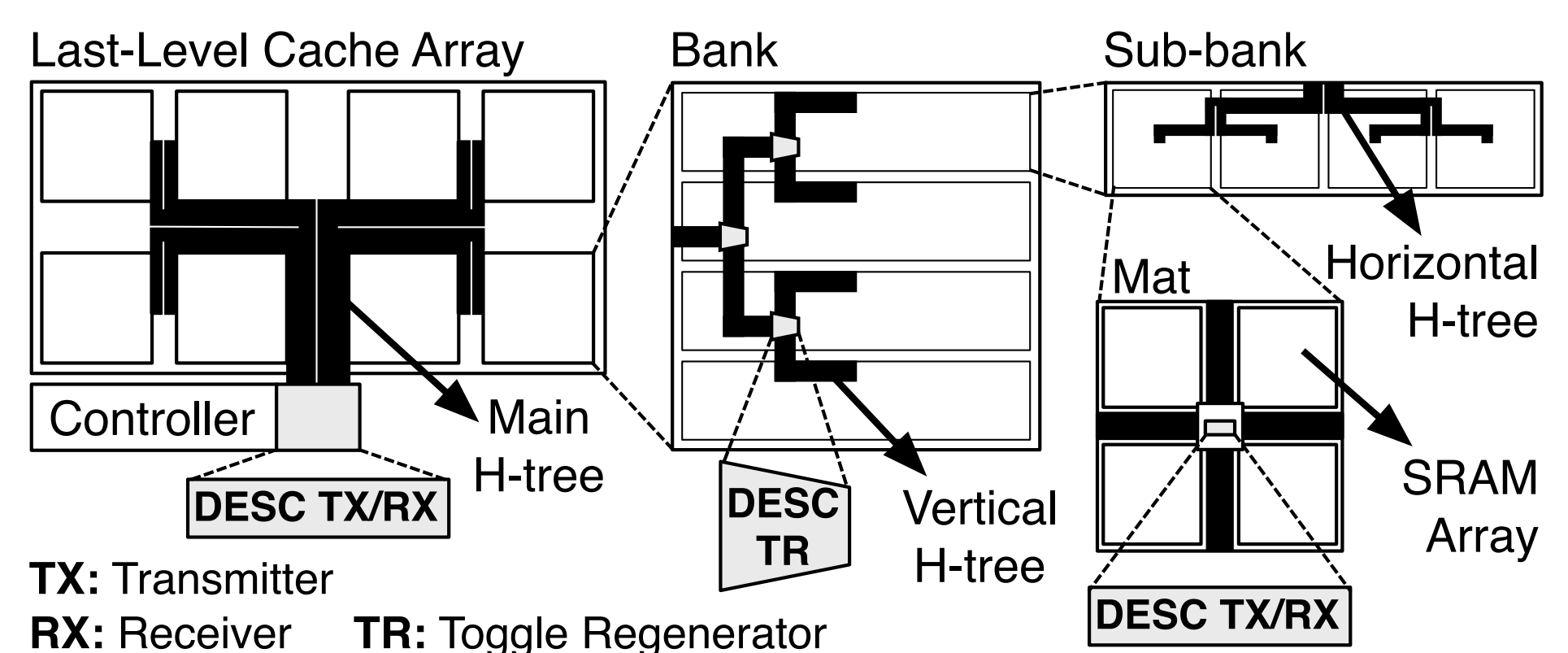
- Represent information by the number of clock cycles between two consecutive pulses to reduce interconnect activity factor.
- DESC achieves fewer transitions on the data bus at the cost of longer transfer time.

Example: transmitting the value 5

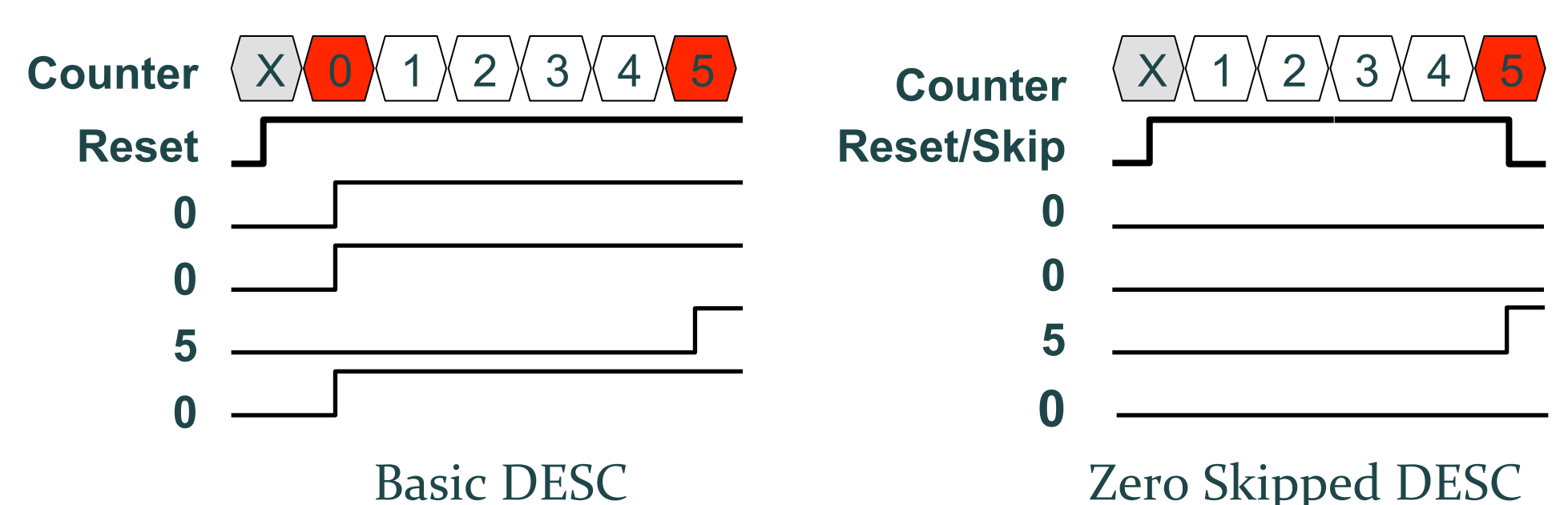


## Design Highlights

- DESC transfers values using toggles on the cache interconnect.
- A **transmitter** generates the necessary transitions on the communication wires.
- A **receiver** detects the communication strobes sent by the transmitter, and recovers the data values.
- A **toggle regenerator** receives toggles from one of the two branches of the vertical tree, and transfers the toggles upstream



- DESC exploits regularities in the transmitted data value stream to reduce power and delay.



## Evaluation

- DESC reduces LLC energy by 1.8x at the cost of a 2% increase in execution time.
- DESC expands the Pareto frontier in energy-efficient cache design.

