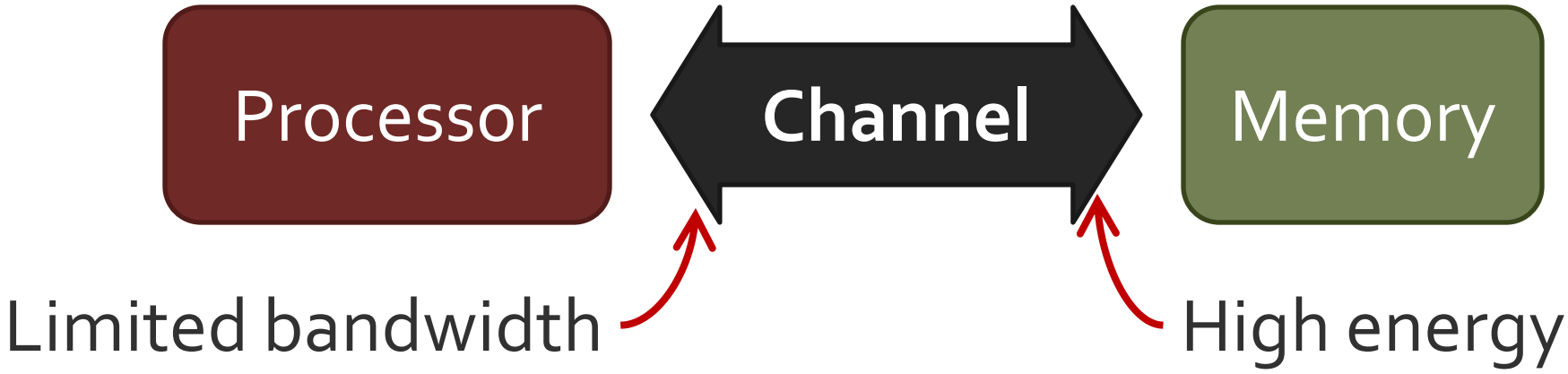
RowClone: Fast and Energy-Efficient In-DRAM Bulk Data Copy and Initialization



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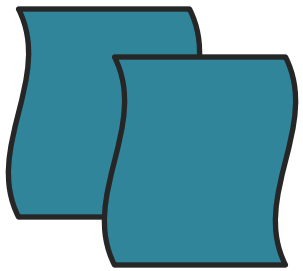
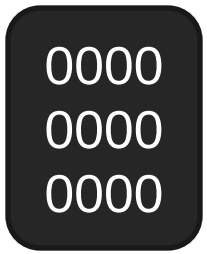
RowClone: Fast and Energy-Efficient In-DRAM Bulk Data Copy and Initialization

Bulk Data Copy

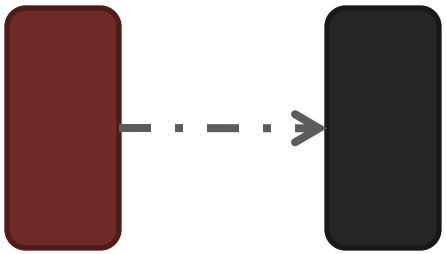
Data Initialization



Forking



Zeroing



Checkpointing

VM Cloning

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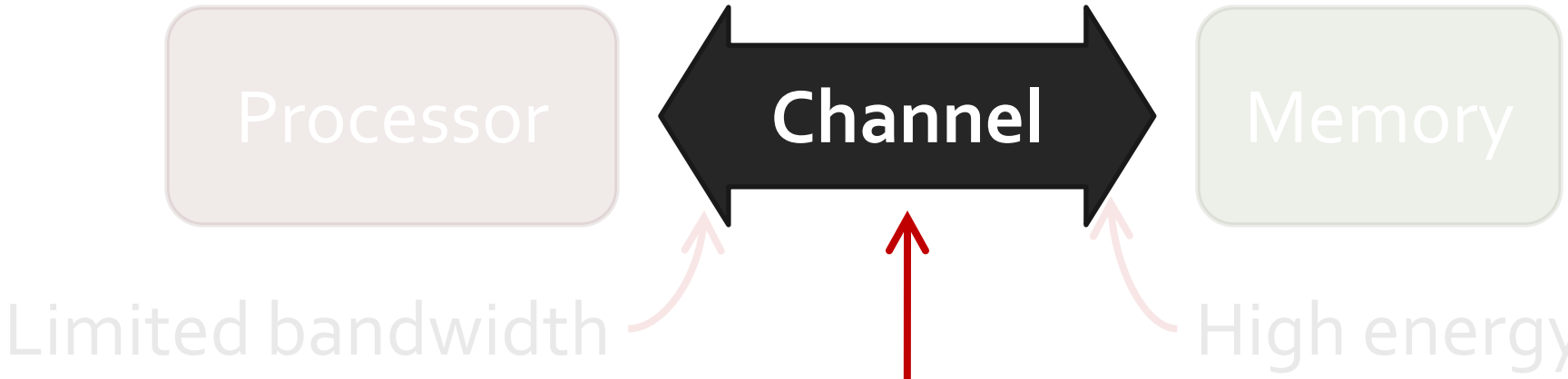
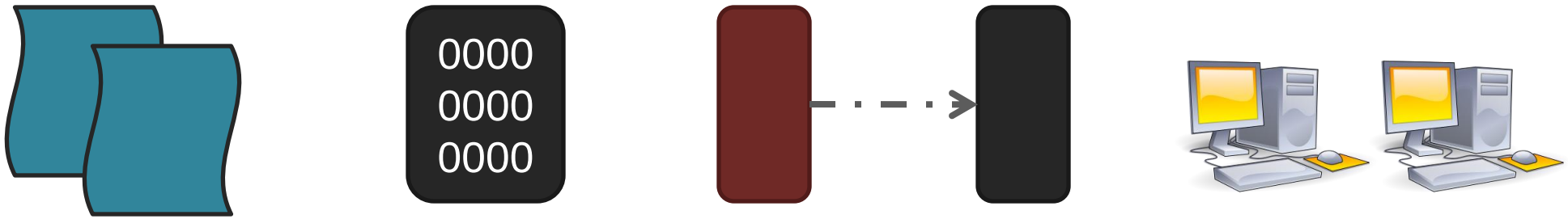


Bulk Data Copy **Data Initialization**

Unnecessary Data Movement



Forking Zeroing Checkpointing VM Cloning

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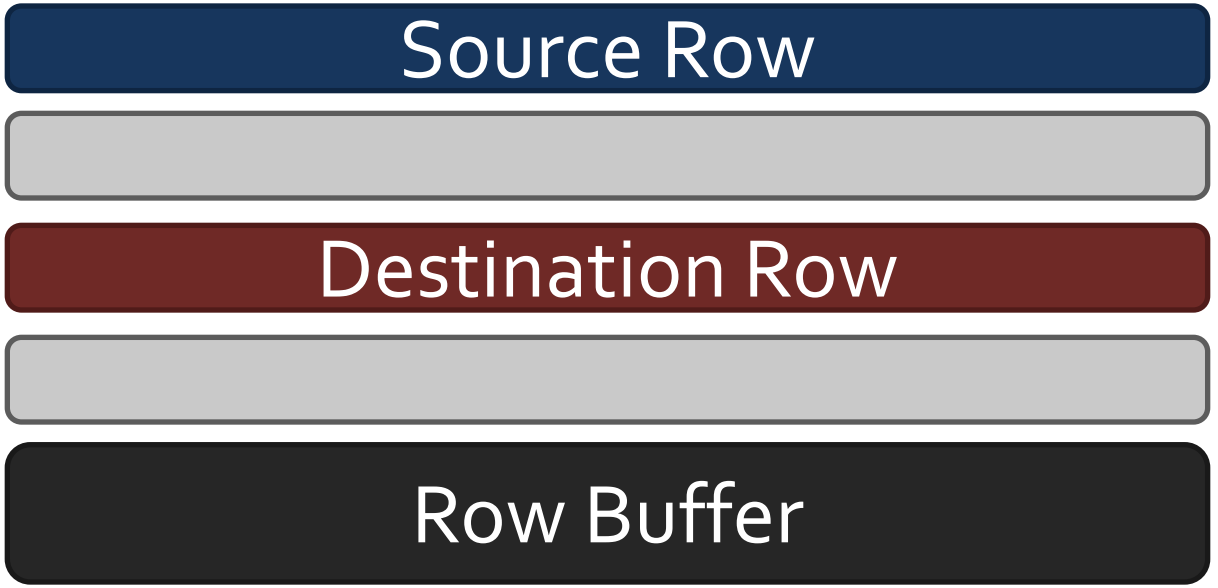
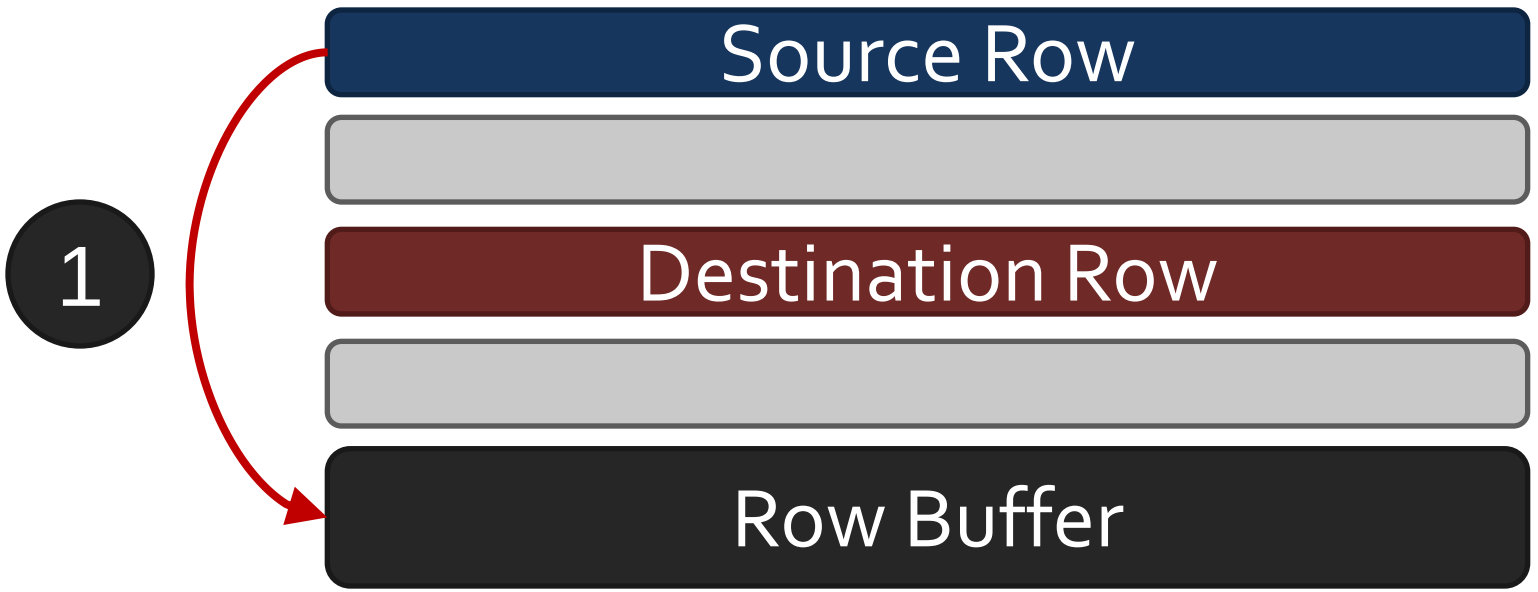
RowClone: In-DRAM Bulk Copy & Initialization

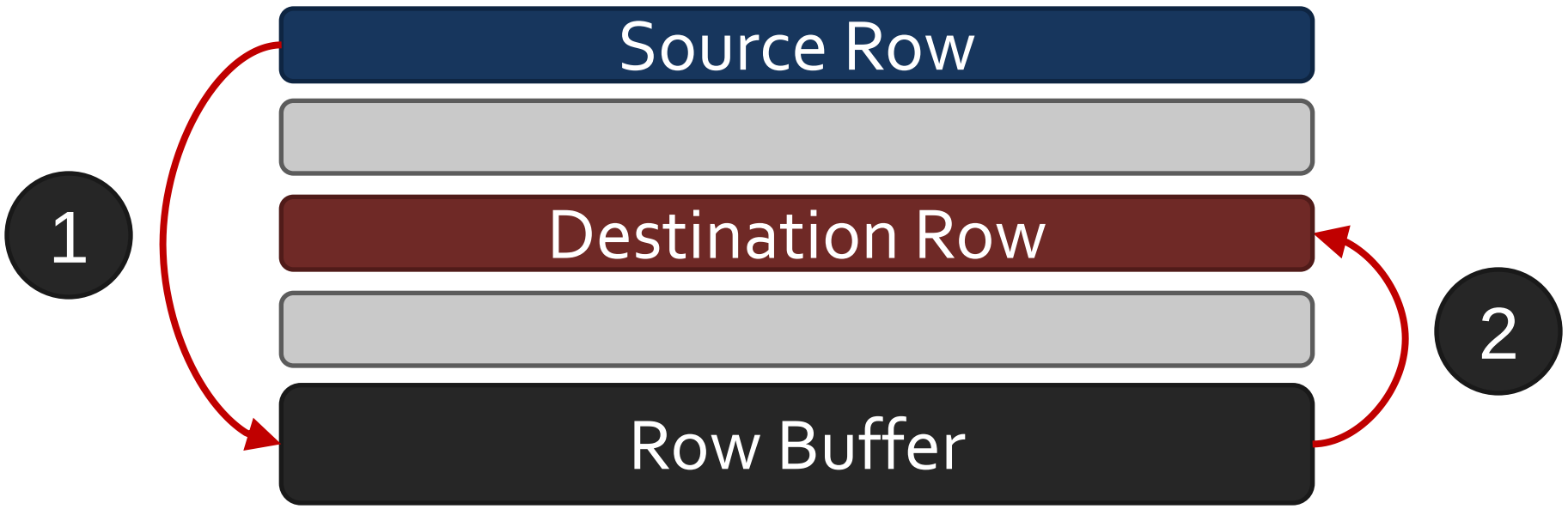


RowClone: In-DRAM Bulk Copy & Initialization



Copy from source row to row buffer

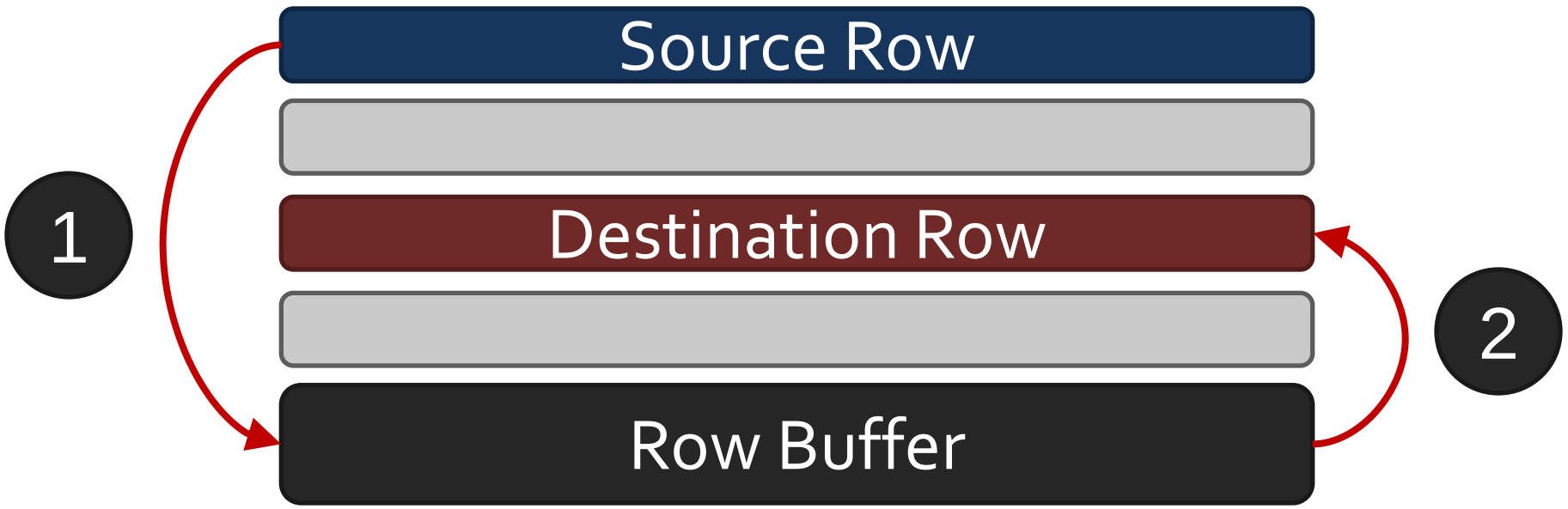
RowClone: In-DRAM Bulk Copy & Initialization



Copy from source row to row buffer

Copy from row buffer to destination row

RowClone: In-DRAM Bulk Copy & Initialization



Copy from source row to row buffer

Latency **11x** ↓

Copy from row buffer to destination row

Energy **74x** ↓

Very few changes to DRAM
(0.01% increase in die area)

RowClone: In-DRAM Bulk Copy & Initialization

- End-to-end system design to exploit DRAM substrate
- Several applications that benefit from RowClone

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