CS250 Discussion 4
SRAMs

Spring 2016

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Lab 3 Preview

- In lab 2, you changed the memory controller to take advantage of multiple in flight requests
  - You also experimented with pipelining
- In lab 3 you will experiment with:
  - Replacing the message buffer with an SRAM
  - Using a multi-Vt flow
  - Writing a script to parse reports

Why use SRAM Arrays?

- SRAMs are typically denser than flip-flop arrays*
  - Not necessarily true for very small arrays
  - Not necessarily true for large numbers of ports
- *Static*, meaning they hold state as long as power is applied
  - DRAM requires periodic refreshing of charge on capacitor
- Faster than DRAM
- Standard CMOS (no need for special DRAM process)

A good reference is *CMOS VLSI Design: A Circuit and Systems Perspective (4th ed)* by Weste and Harris

Flip-Flop Arrays vs. SRAMs

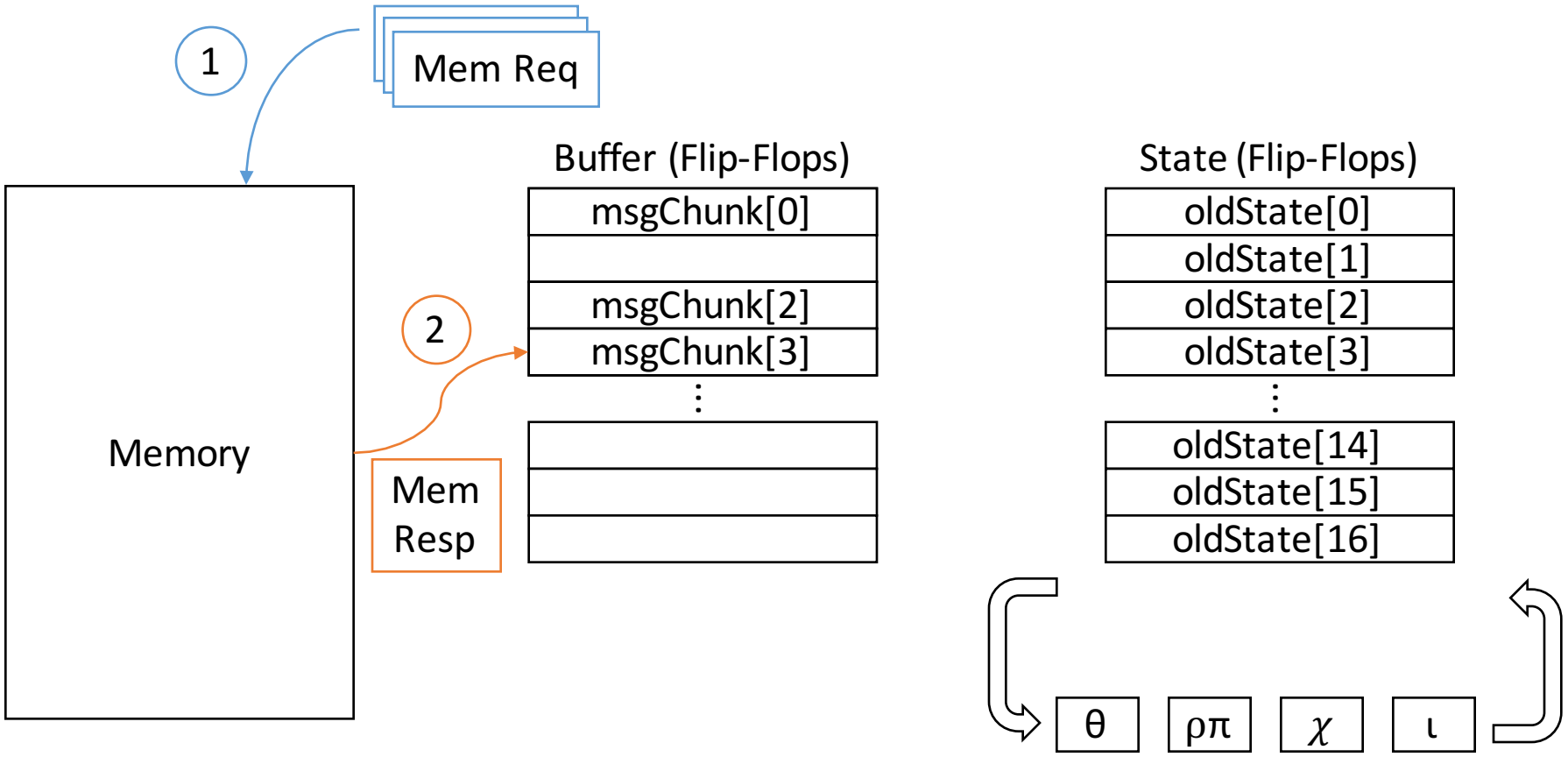
Flip-Flop Arrays (Registers)

- Can access as many elements at a time as you want (may need multiplexers to select)
- Can read the previous value from an element while writing the new one

SRAMs

- Number of ports limits how many simultaneous reads/write you can do at once
  - Read and write ports are not always the same
- Simultaneously reading and writing the same elements may produce unexpected result
  - Unlikely to behave like register

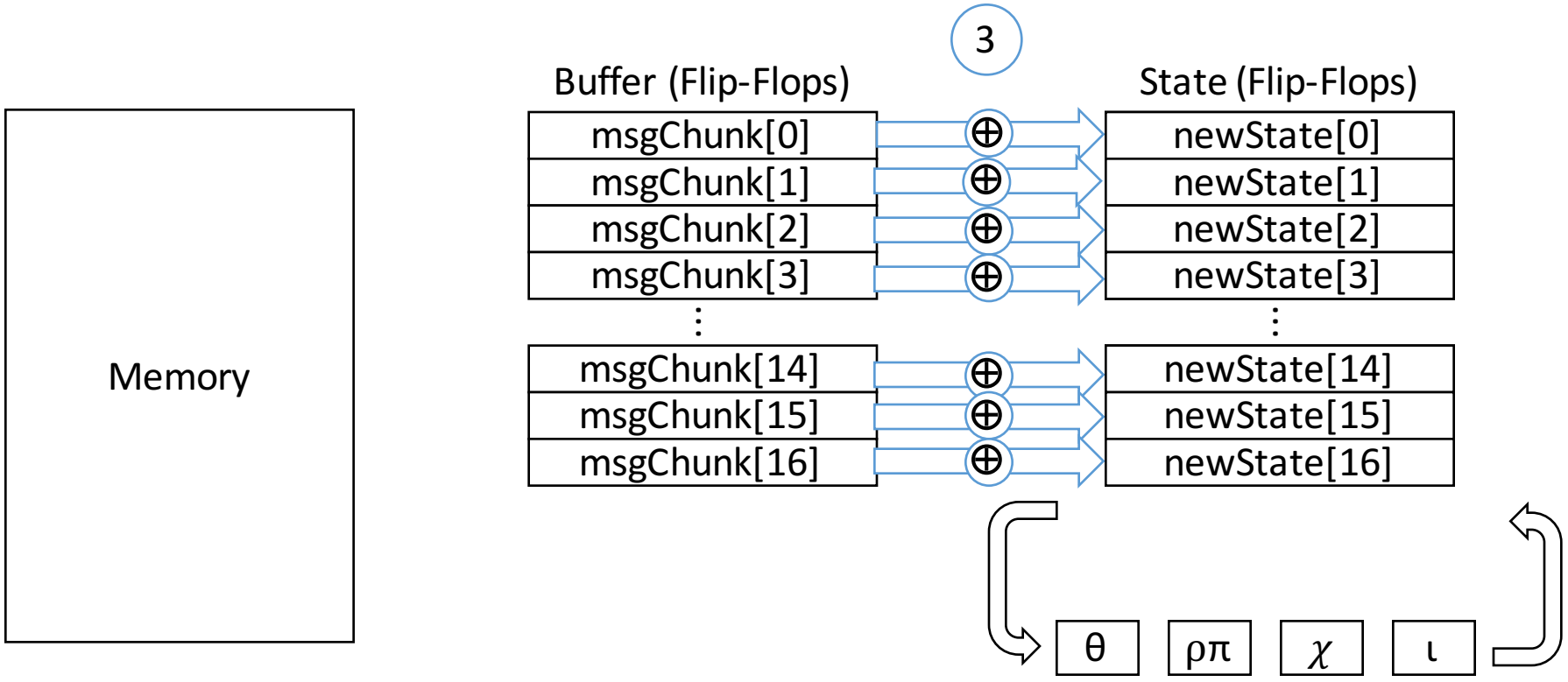
The Current Solution



1 Send Requests to Memory

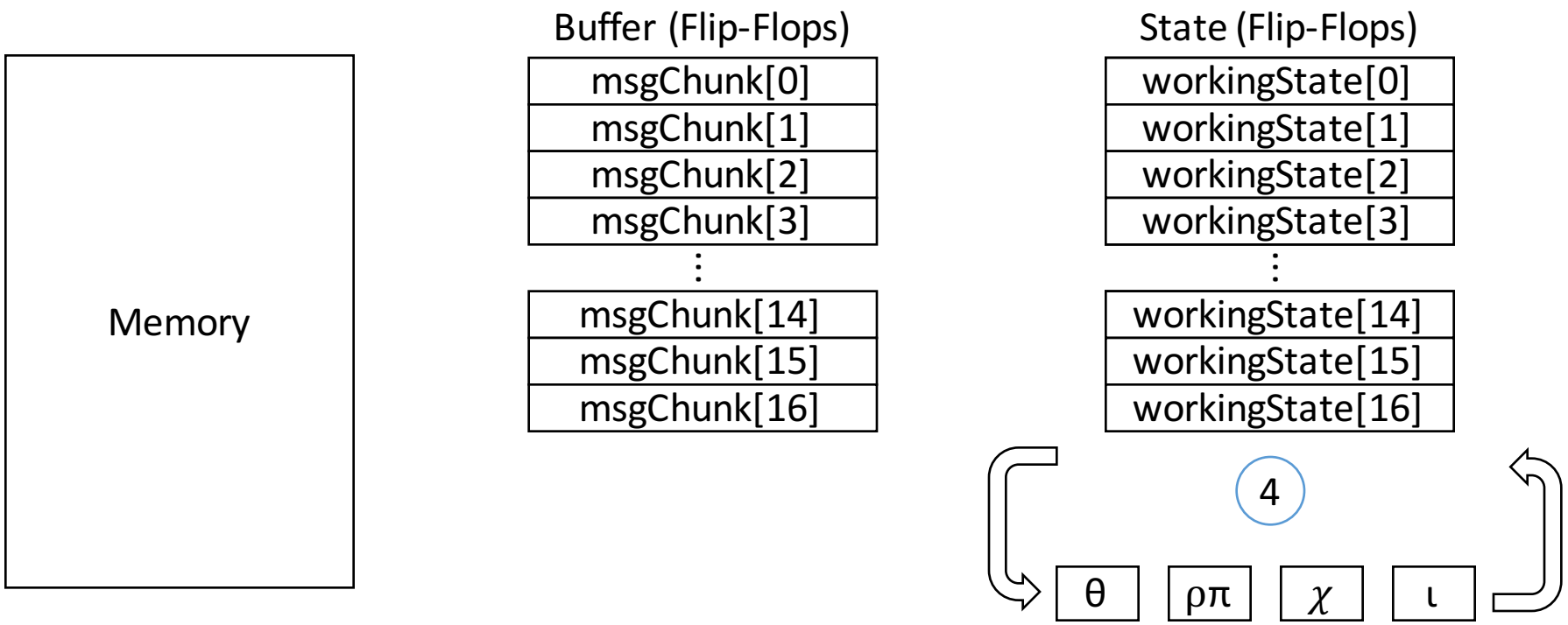
2 Place Responses Into the Buffer (only one response at a time but possibly out of order)

The Current Solution



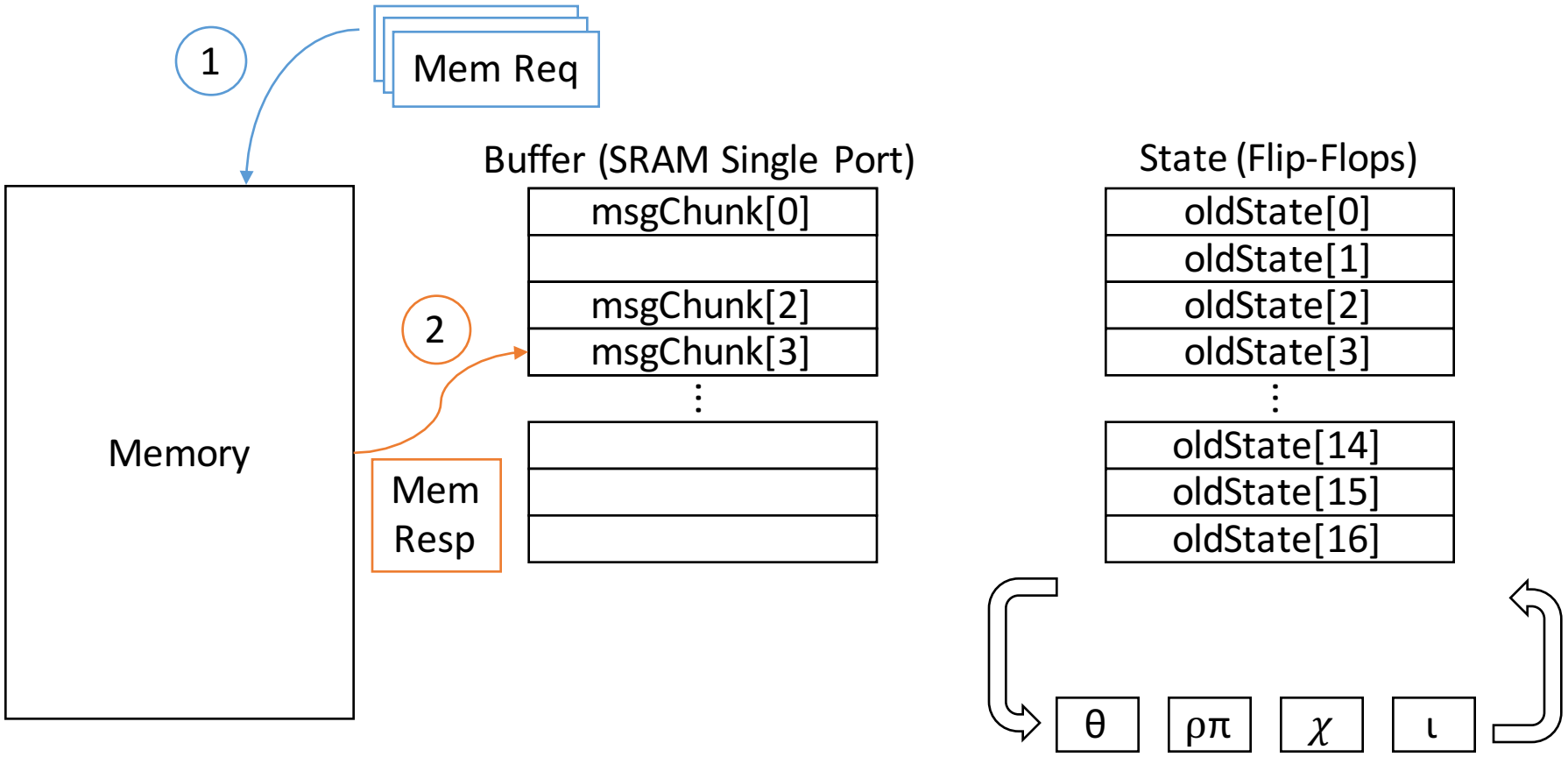
3 Absorb by XOR-ing each buffer entry with the old state (simultaneously)

The Current Solution



4 Start the data path

The SRAM Solution



1 Send Requests to Memory

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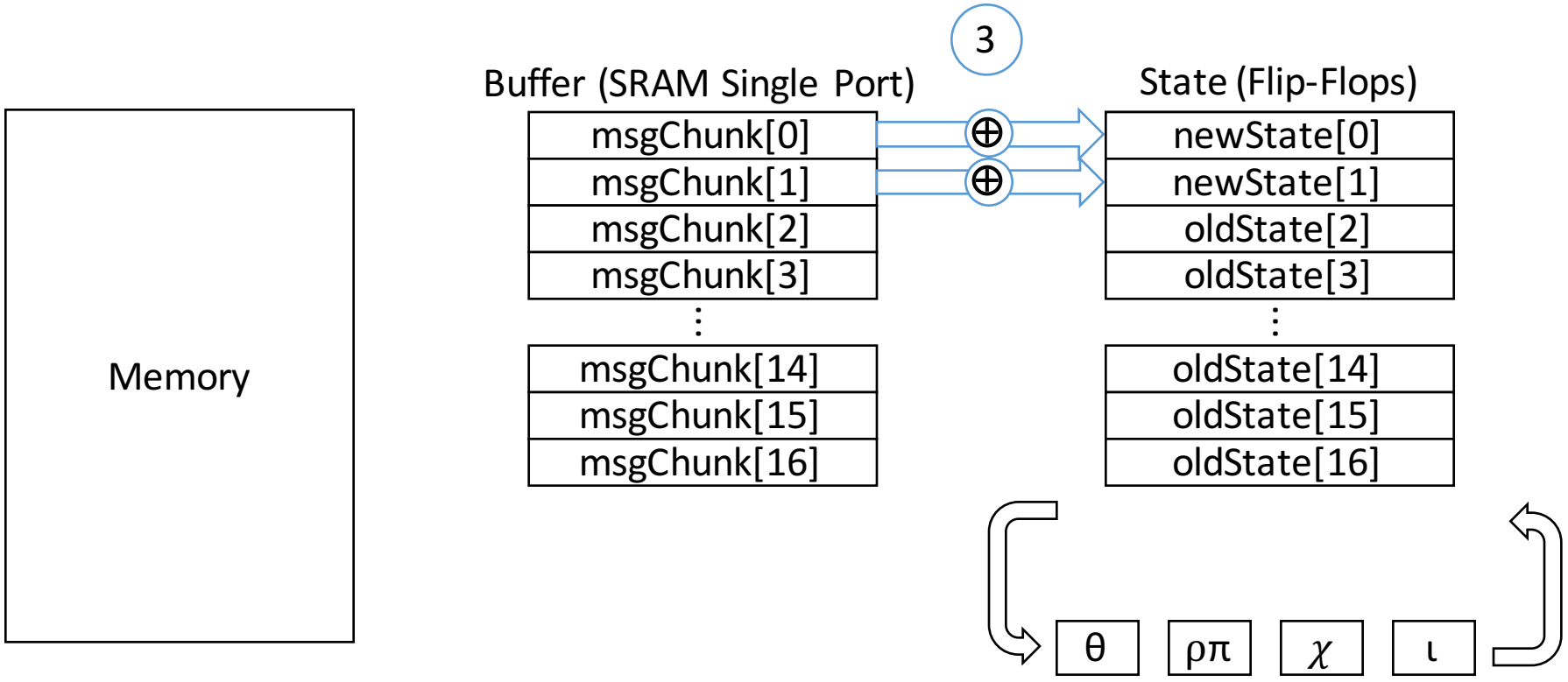
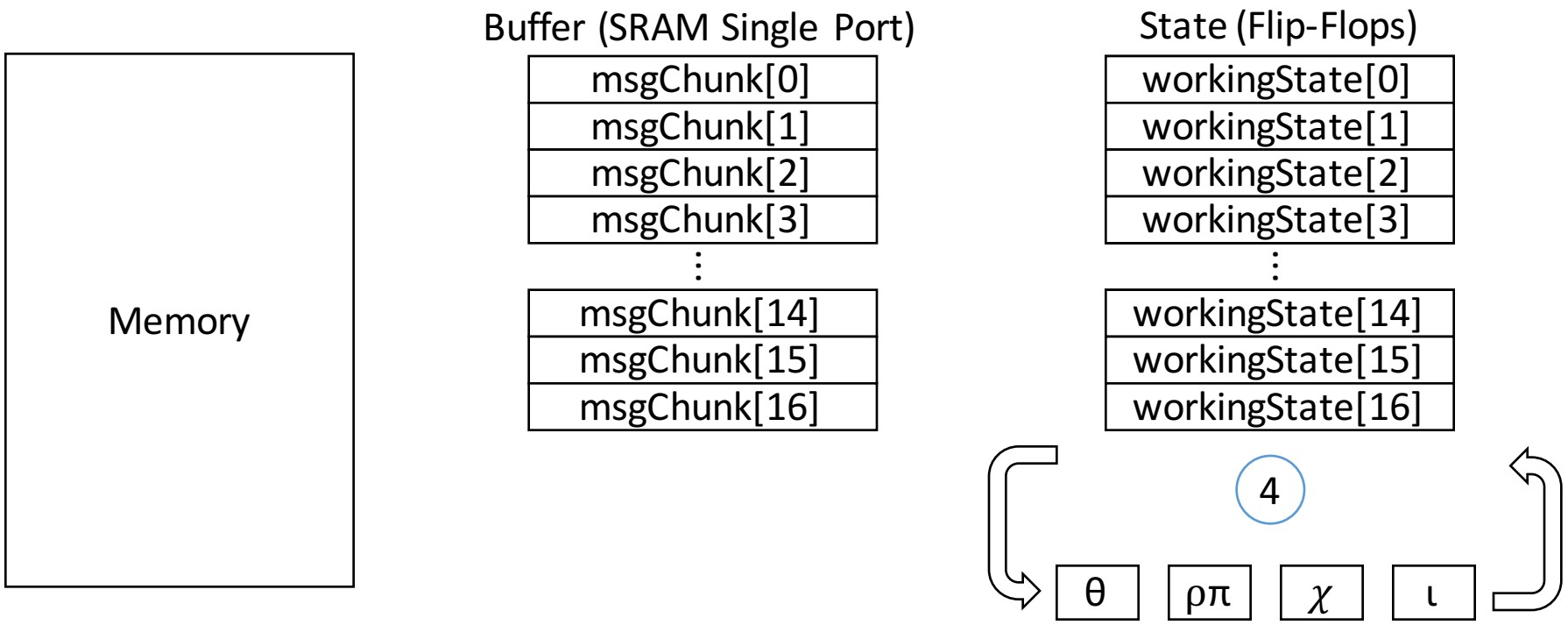
The SRAM Solution



3 Absorb by XOR-ing each buffer entry with the old state (***one word at a time***)

The SRAM Solution



4 Start the data path

Multi Vt Flow

- Until now, you have only been using standard cells with one Vt
- Changing the Vt effects the speed and power of cells
  - LVT – faster but more power hungry
  - HVT – slower but less power hungry
- Tool will place LVT cells on the critical path to speed it up and will place HVT cells outside of the critical path to save power

Parsing Reports

- There are several scripting languages that you can use
  - Python, ruby, perl, awk, sed, …
  - Doesn't really matter what language you use.
- Regex will probably be your friend
  - There is a tutorial for python at https://docs.python.org/2/howto/regex.html
- Take pride in your script … it will probably help you in your project!
  - Good script writing: taking more time initially to save a bunch of time later