Speed And Accuracy Dilemma In NoC Simulation: What About Memory Impact?

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Context

Manycore processors integrating a NoC are there

- Intel Xeon Phi
- Kalray MPPA2-256
- TILE-Gx72

NoC simulation tools are needed (and already there)

- **Booksim**, NoCTweak, Garnet, Noxim, **McSim**
- The **perfect** simulator is both fast and accurate
- Speed/accuracy dillema

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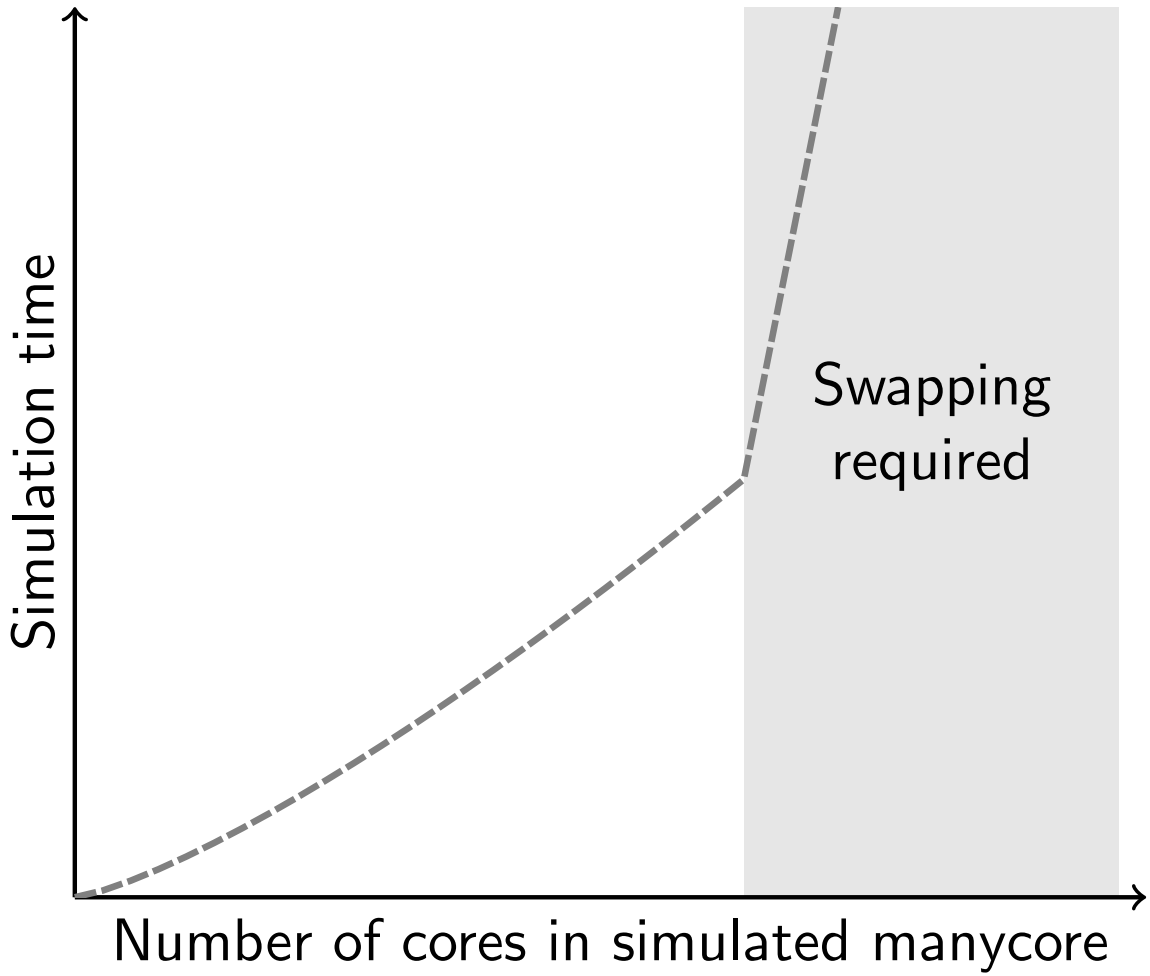
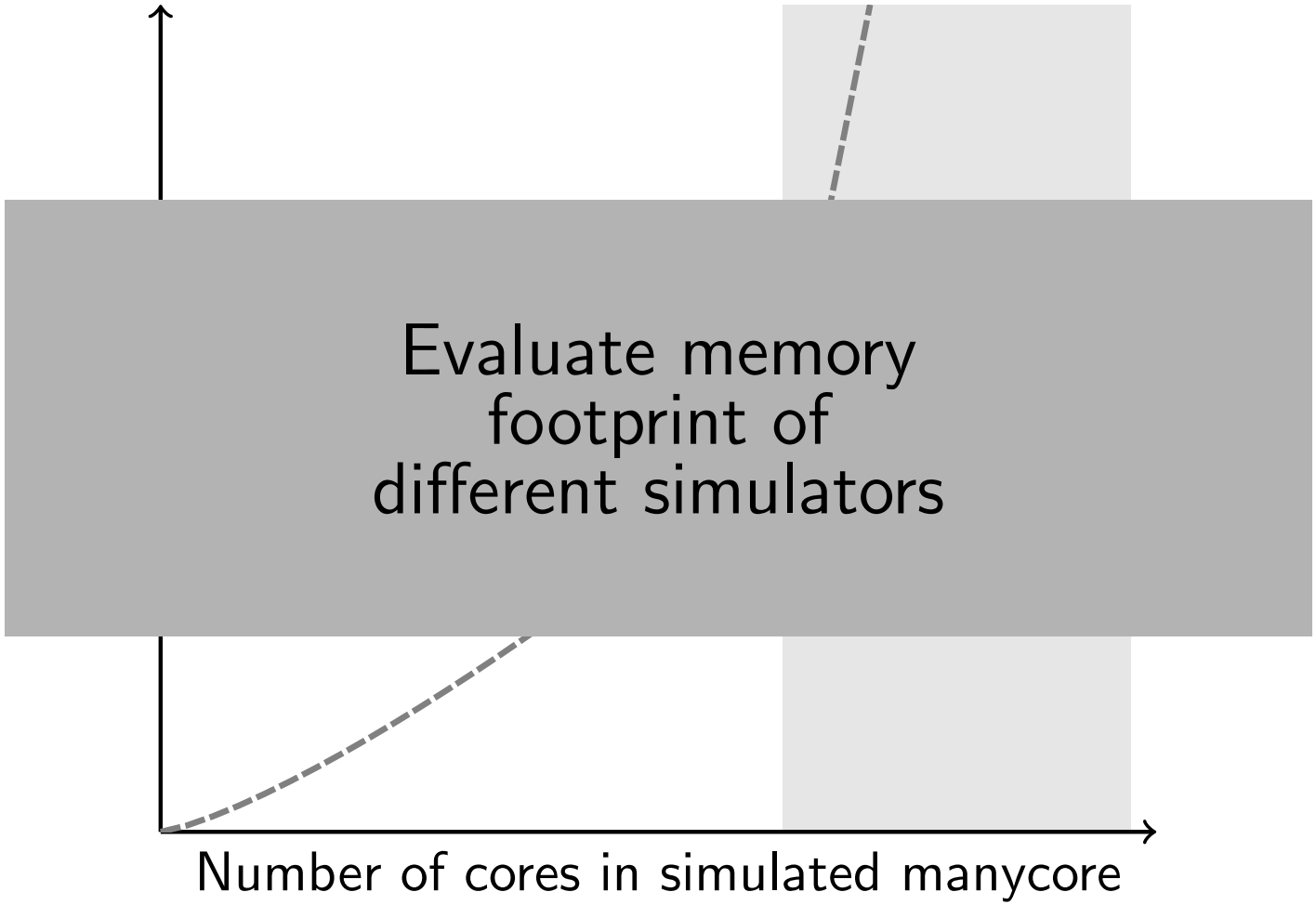
What about memory footprint?

Why Care About Memory Footprint?



Why Care About Memory Footprint?



Outline

Considered Simulators - 2 Criteria

Accuracy

- Bit-accurate
- **Cycle-accurate**
- **Transactional Level Modeling (TLM)**

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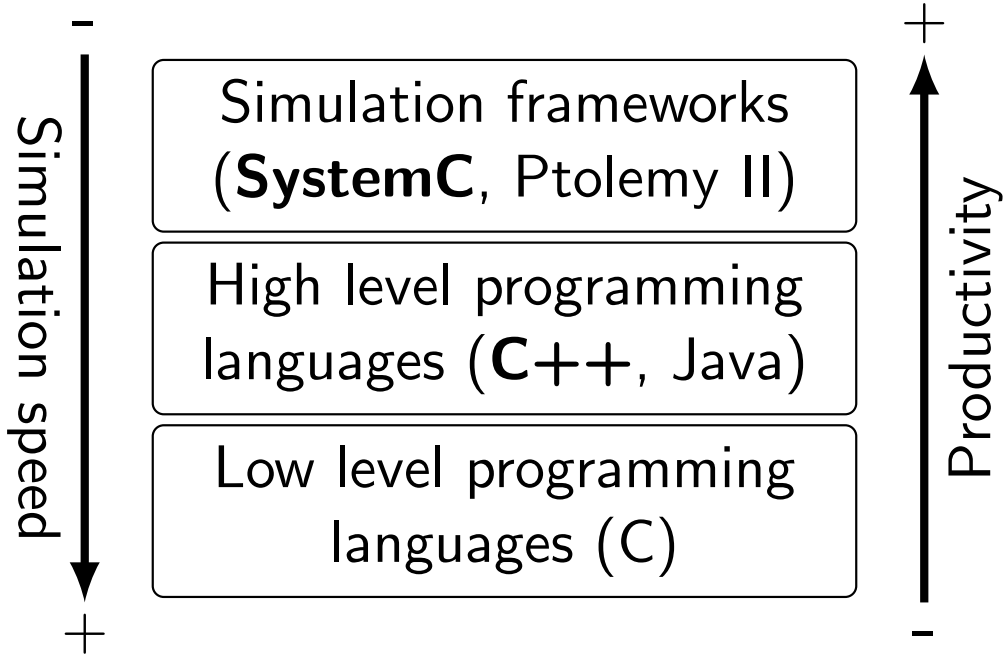
Programming abstraction

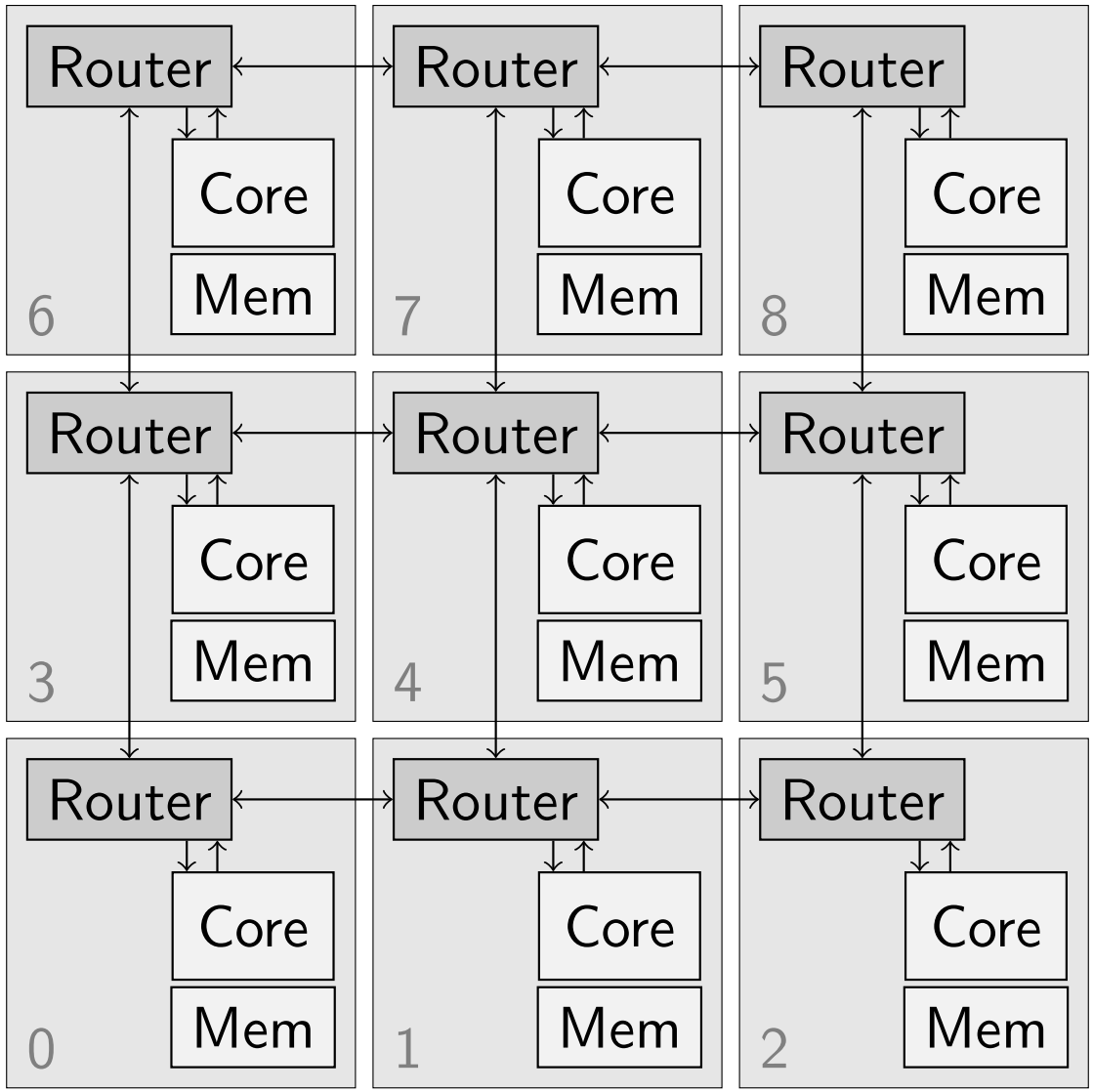


Considered Simulators

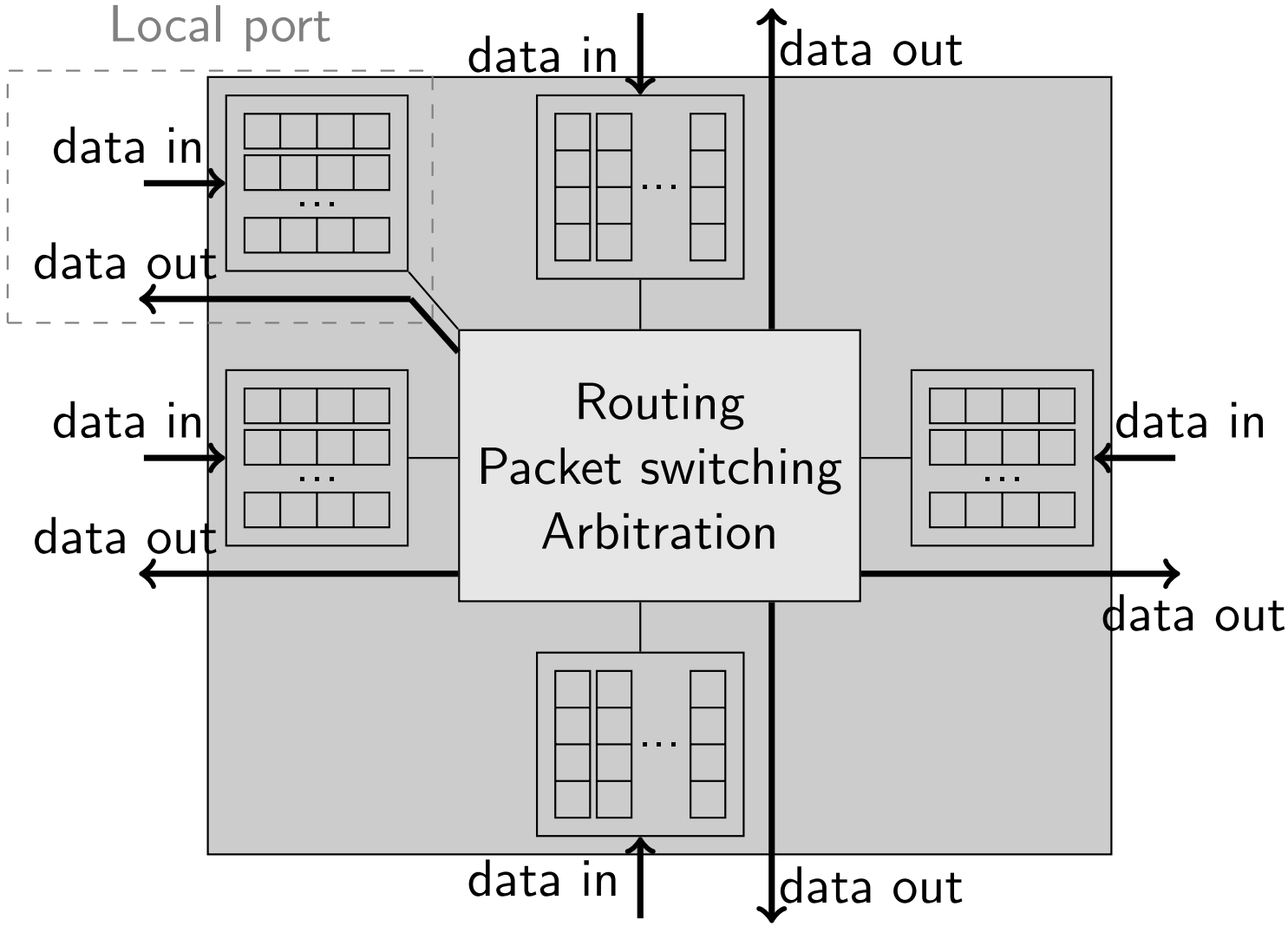
Simulator	*Accuracy*	*Programming abstraction*	*Injector*
McSim-TLM	TLM	SystemC	Application Model
McSim-CA	Cycle-accurate	SystemC	Application Model
Booksim	Cycle-accurate	C++	Random uniform

McSim-CA is based on NoCTweak

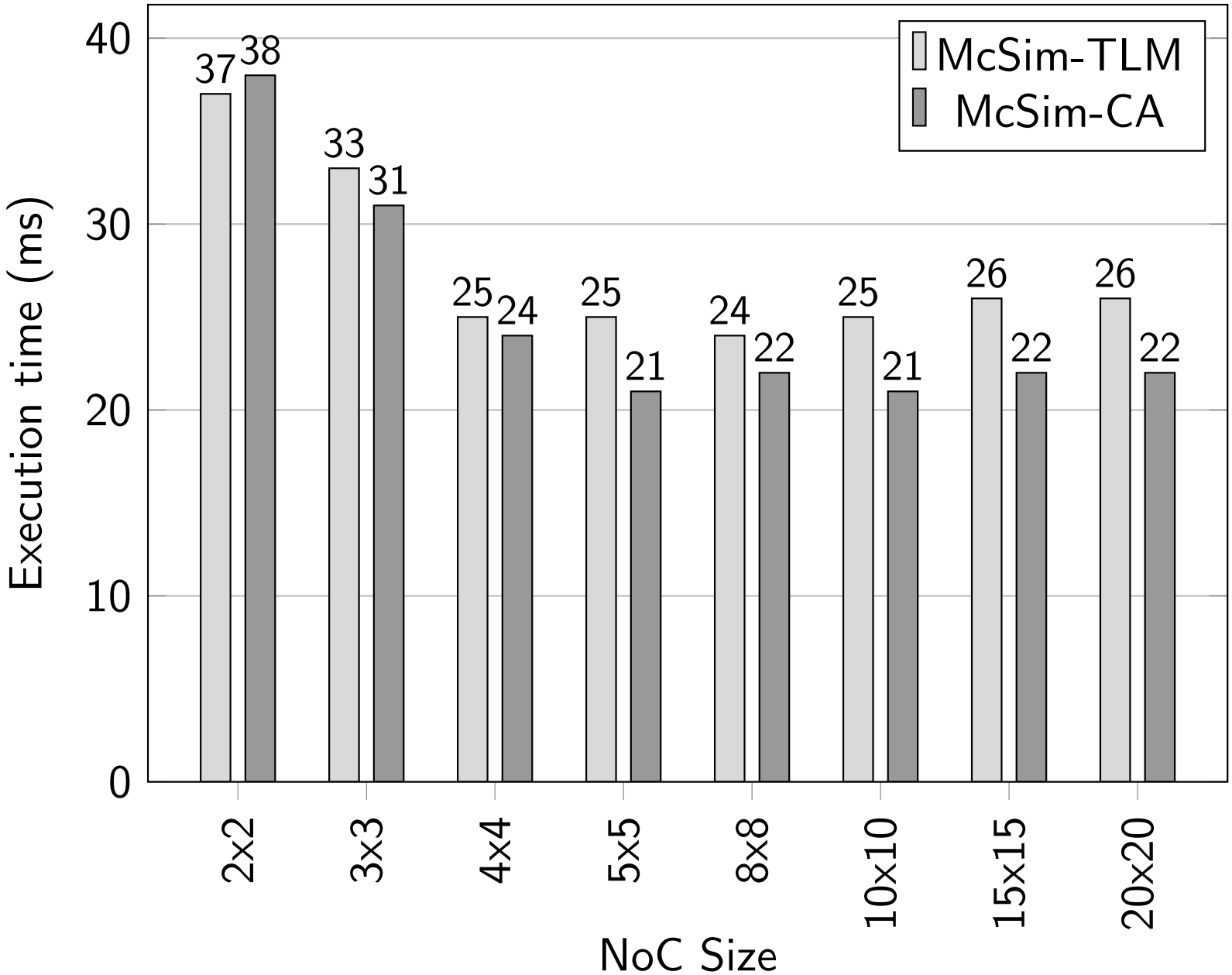
Simulated Hardware - Distributed Memory System



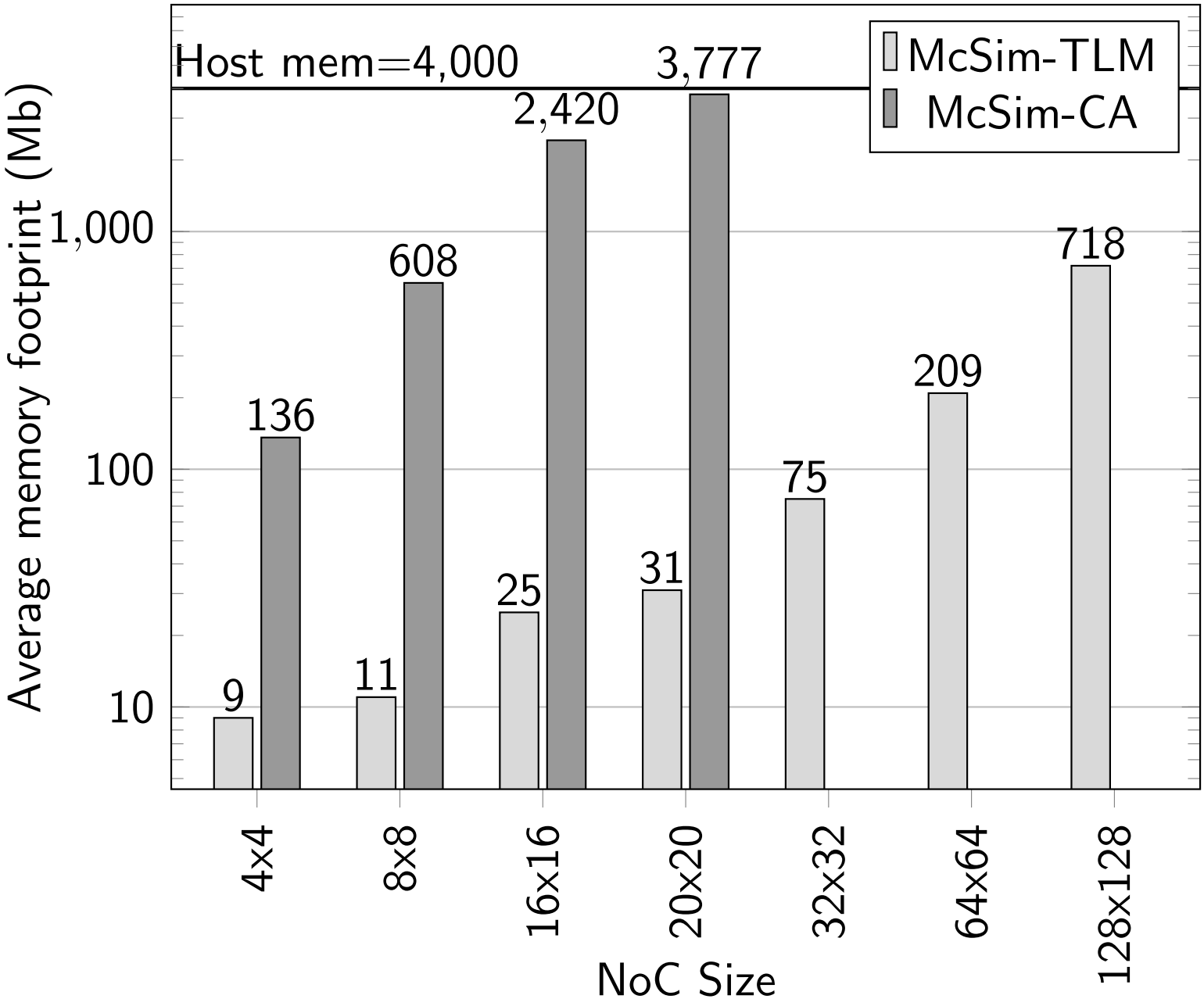
Simulated Hardware - Priority Based Routers



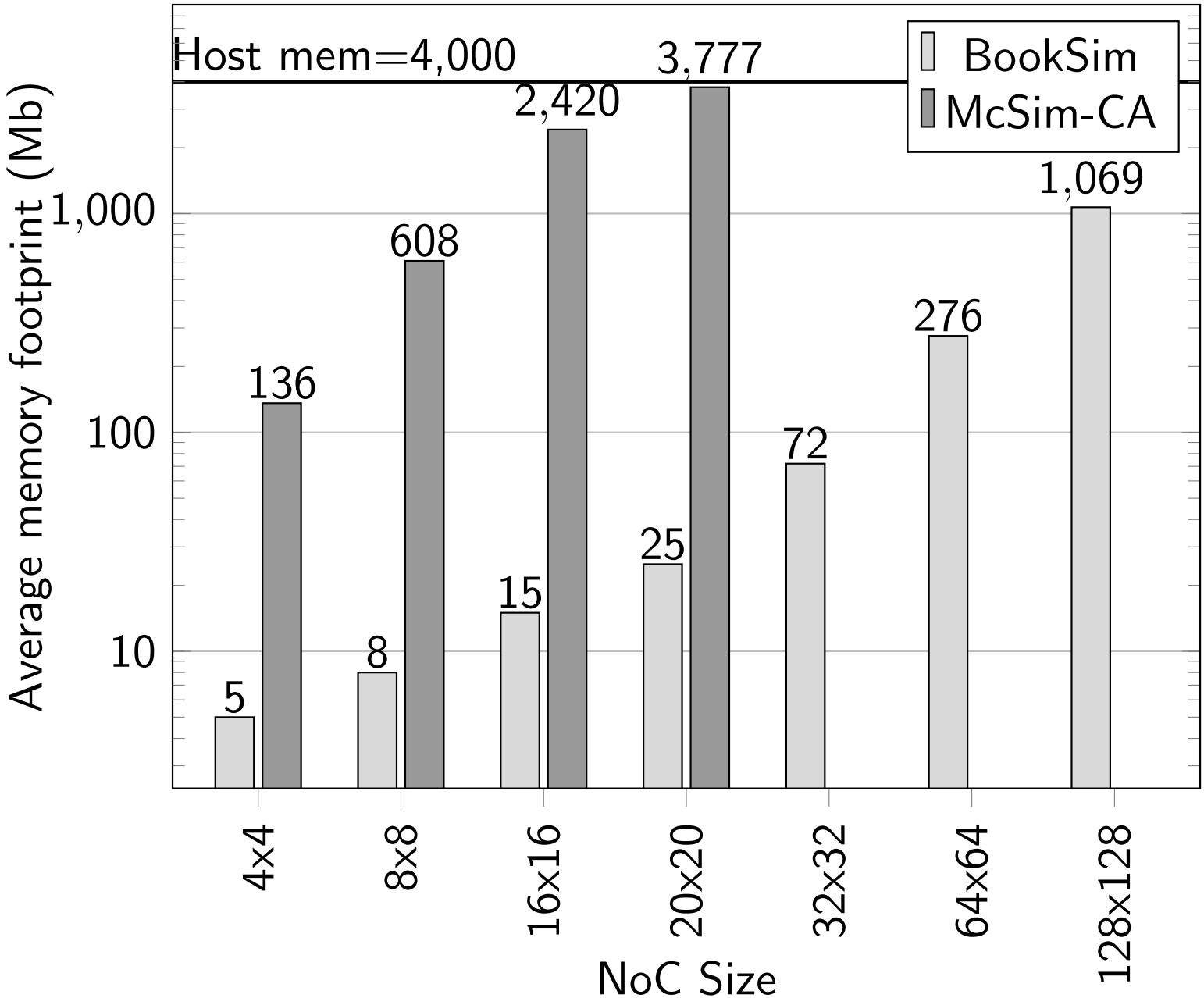
McSim-TLM vs McSim-CA - Accuracy



McSim-TLM vs McSim-CA - Memory Footprint



McSim-CA vs Booksim - Memory Footprint



Deep Memory Footprint Analysis

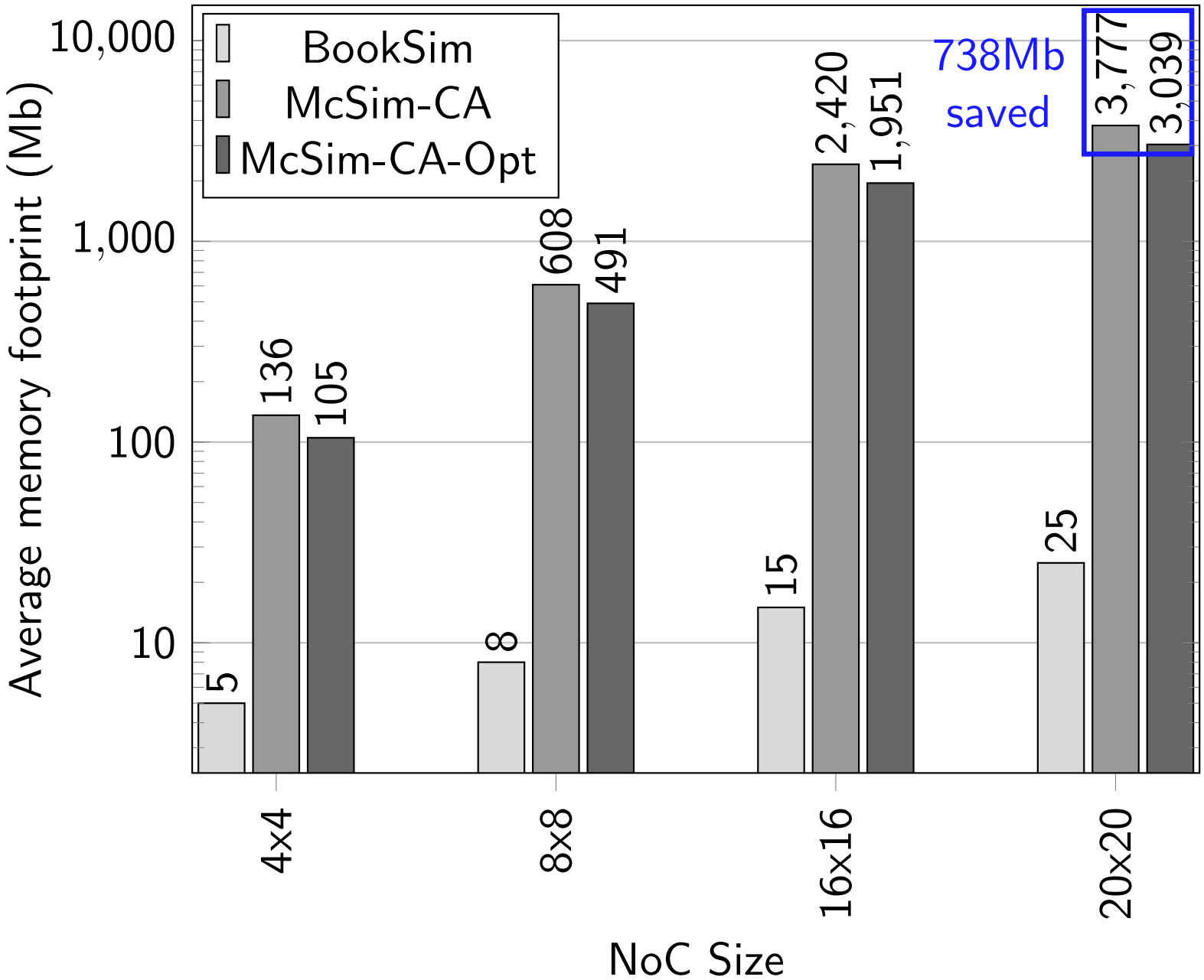
A lot of objects

- Few big objects accounting for 1% of footprint
- A lot of small SystemC objects (3,500,000 for 20x20)

Accellera implementation

- Each SystemC object has a unique name
- Debug purposes
- Required by the standard

Optimized Accellera - Memory Footprint



Conclusion

From TLM to cycle-accurate

- **Costs memory** in addition to CPU

Cycle-accurate concerns

- Programming abstraction **costs memory** in addition to CPU
- SystemC object names can consume **a lot** of memory

Perspectives

- Evaluate memory footprint of other simulators
- Perform lazy allocation in SystemC?

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C++ String Implementation

- g++ 5.2.1
- for a 2 characters string:
  - `stack space = 32, heap space = 0, capacity = 15`
- for a 16 characters string:
  - `stack space = 32, heap space = 17, capacity = 16`
- 15 characters stack buffer to avoid dynamic memory allocation