Work Stealing through Partial Asynchronous Delegation

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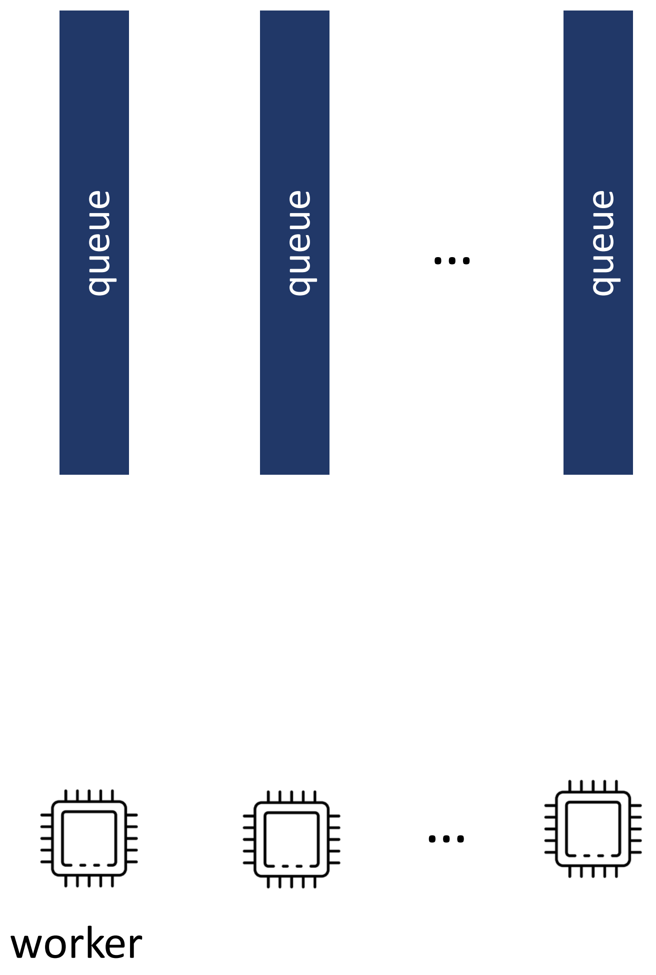
Work Stealing -- Load Balancing for Multi-core Task Processing



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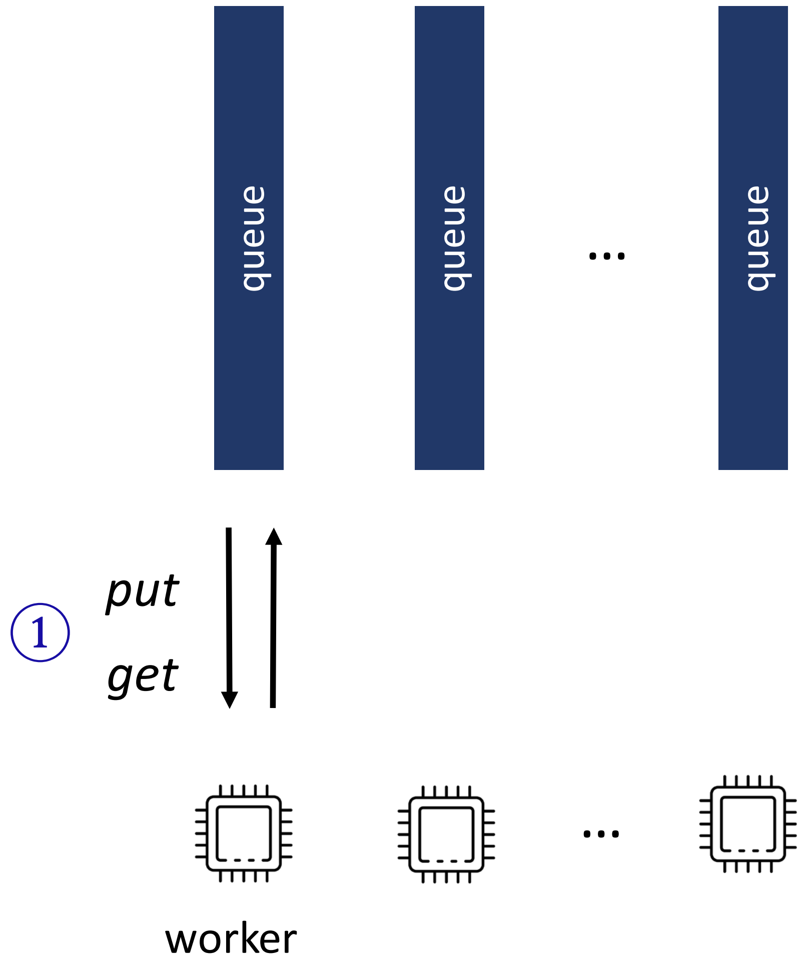

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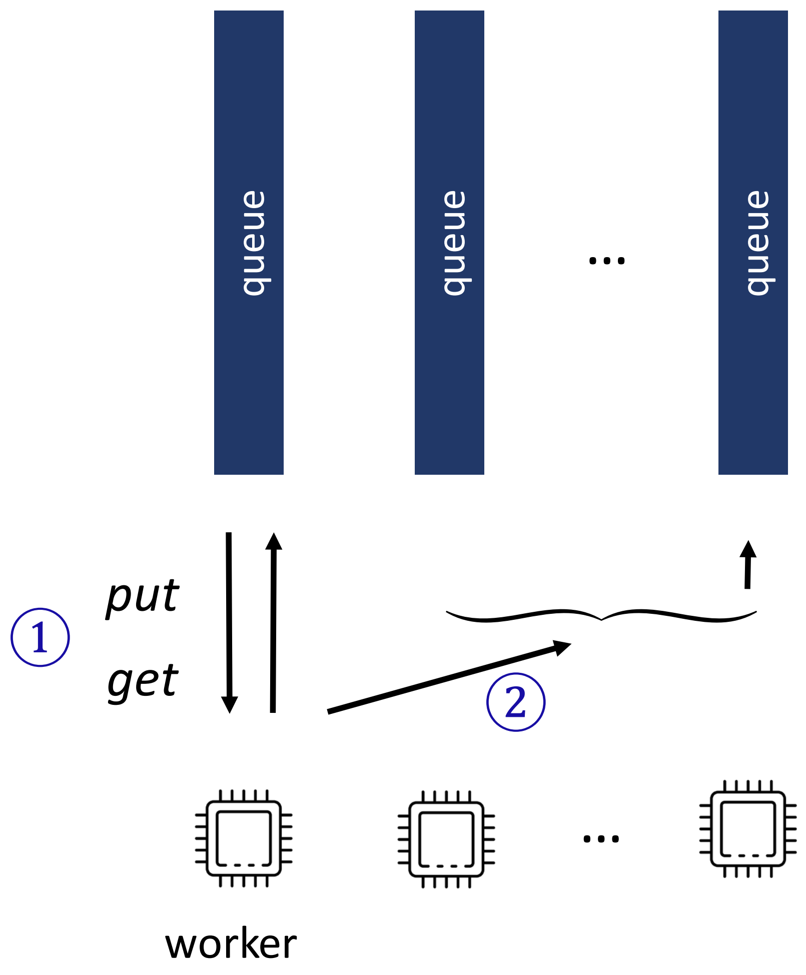

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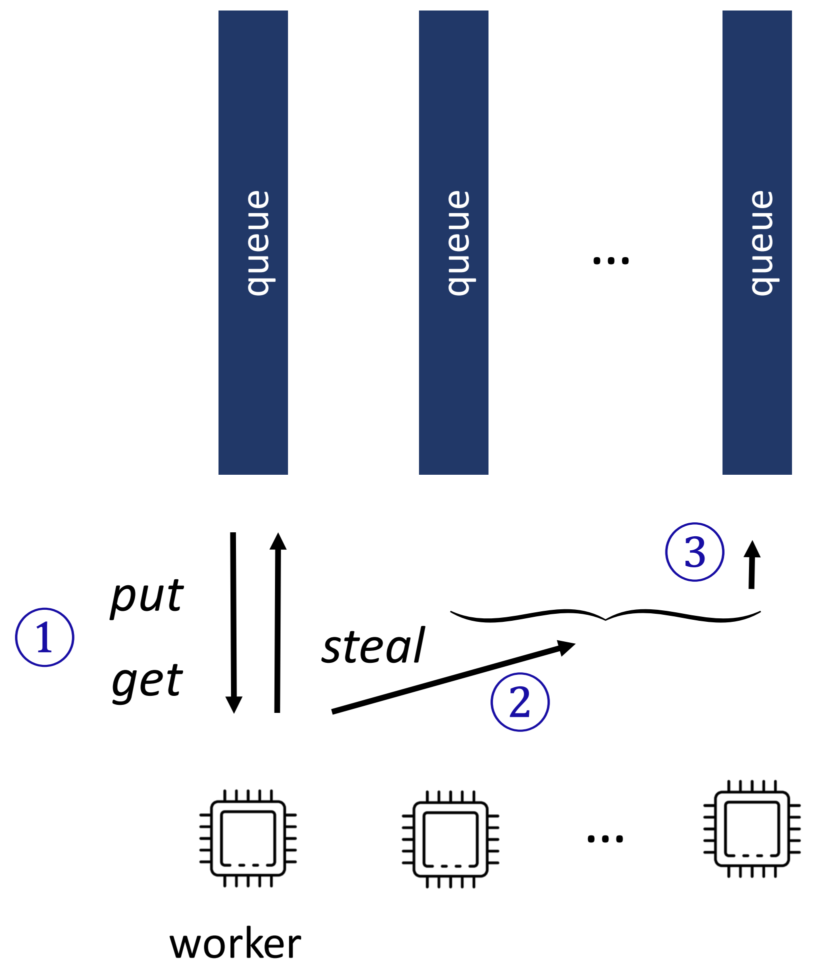

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2. When its queue is empty, it selects another queue
3. and try to steal from it.

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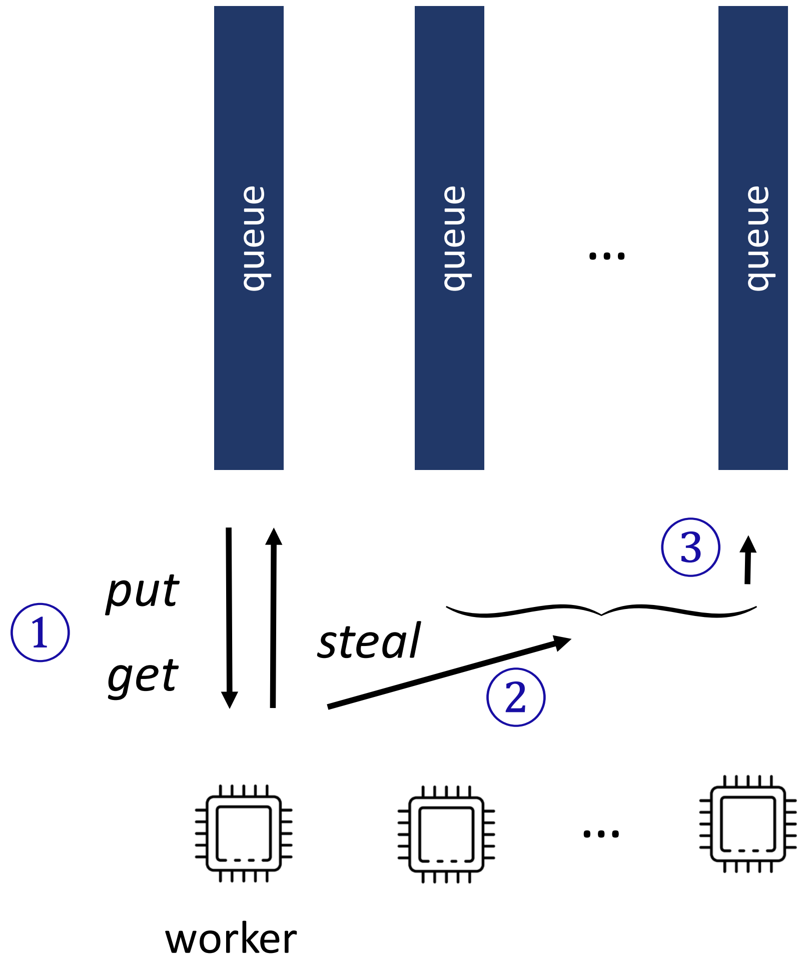

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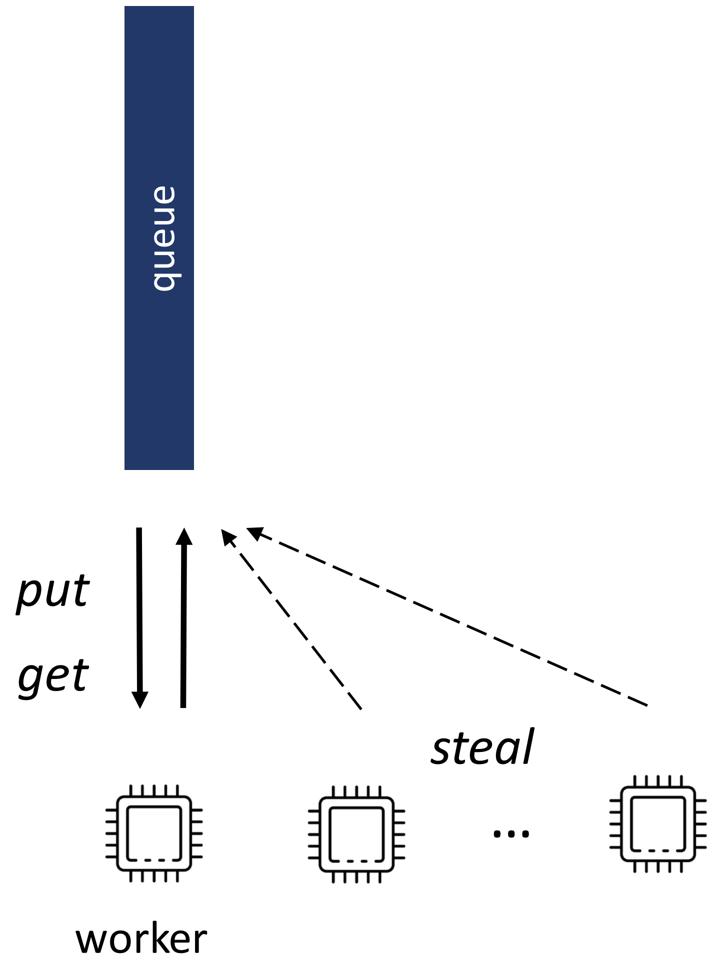
Work Stealing Scenarios

Java, Rust, Go, Julia, Kotlin, JS, OpenCilk, Intel® TBB runtime

Existing Works and Their Limitations



ABP [SPAA’98]:

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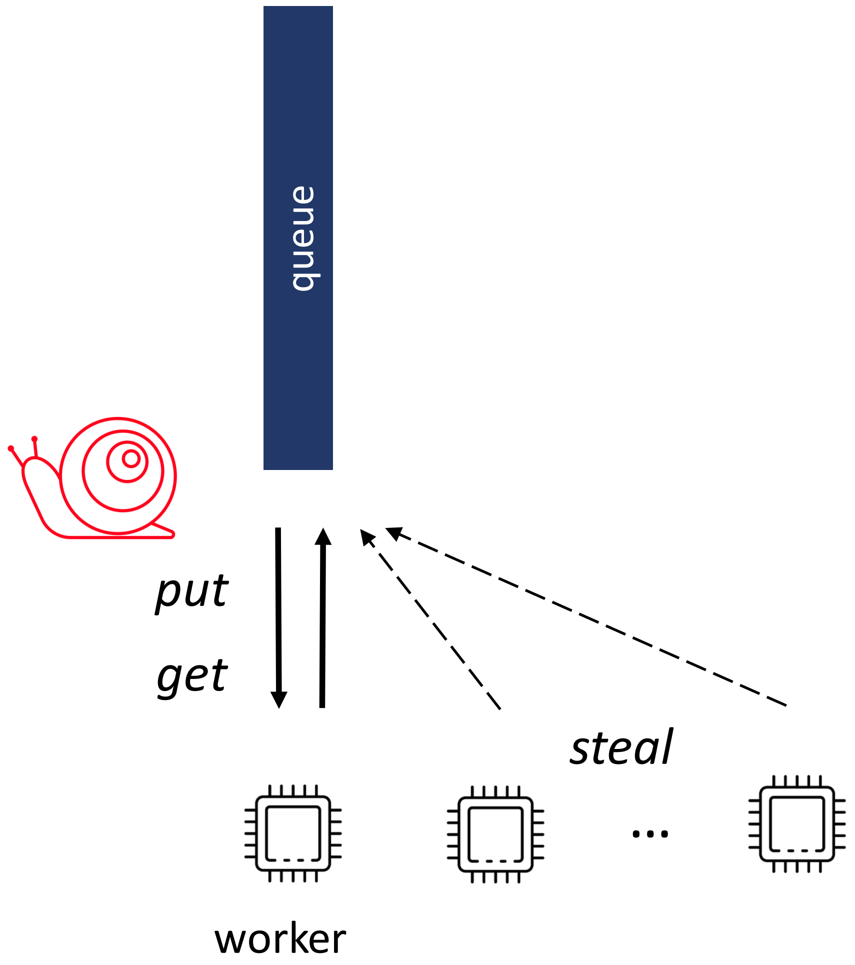

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- Costly synchronization primitives for every pus/get

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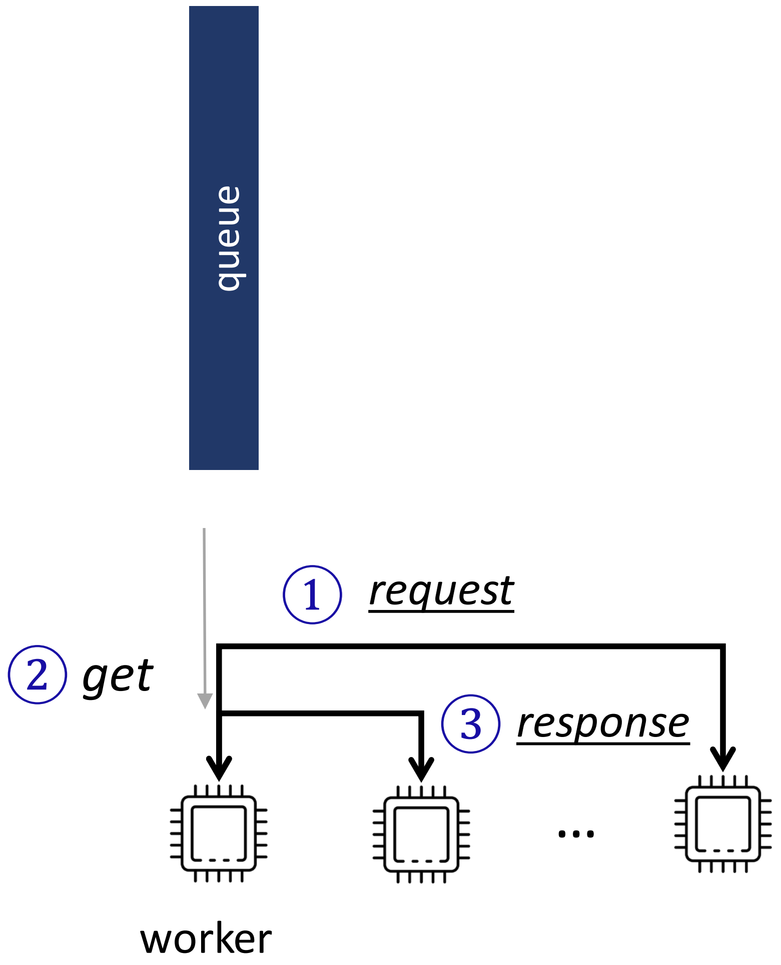

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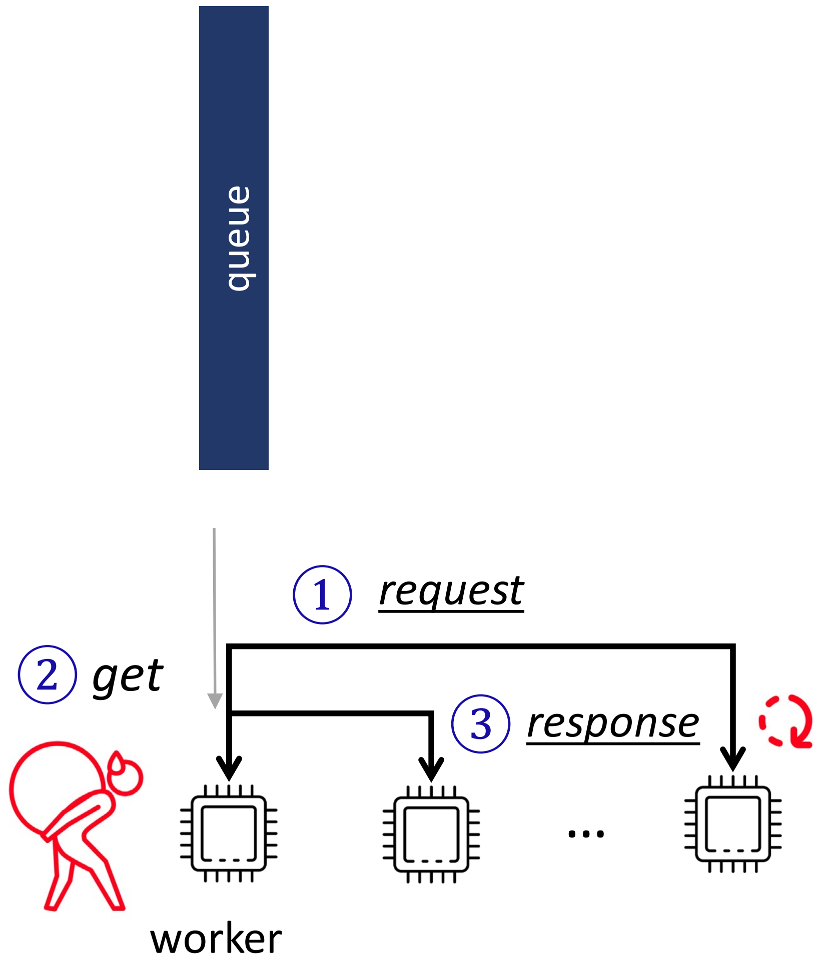

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- The owner is burdened with delegated workloads
- The owner and thieves frequently access the same communication variables (contention)

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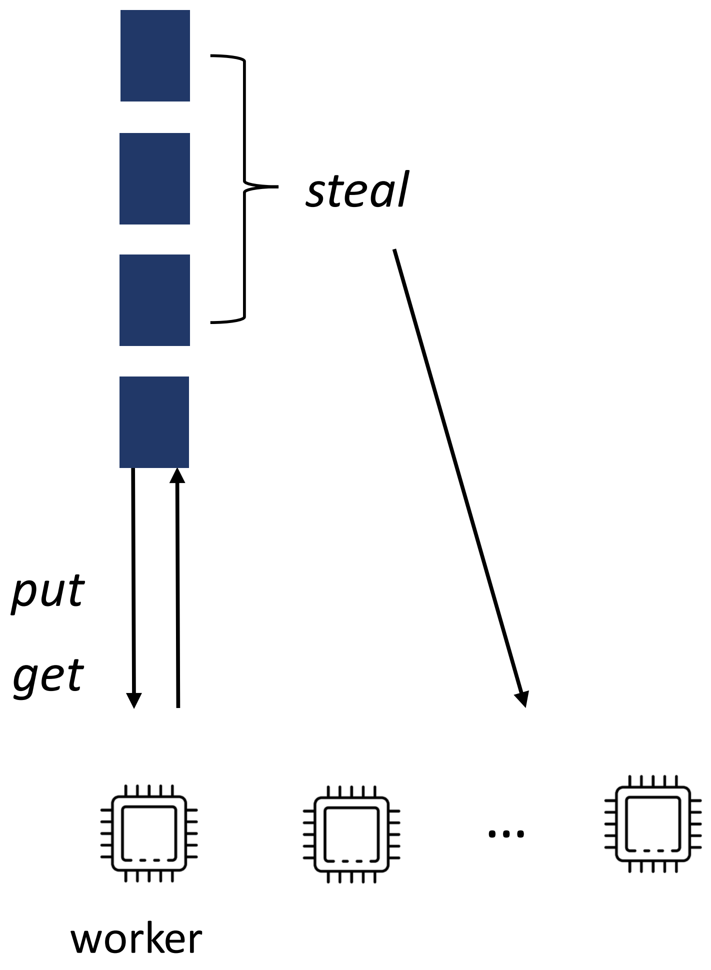

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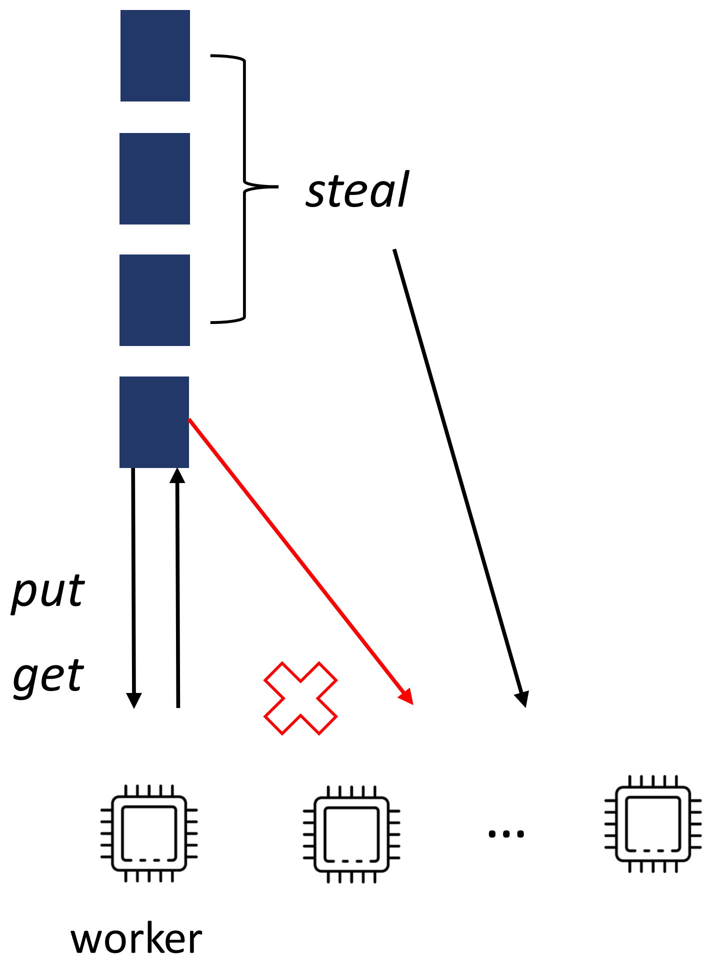

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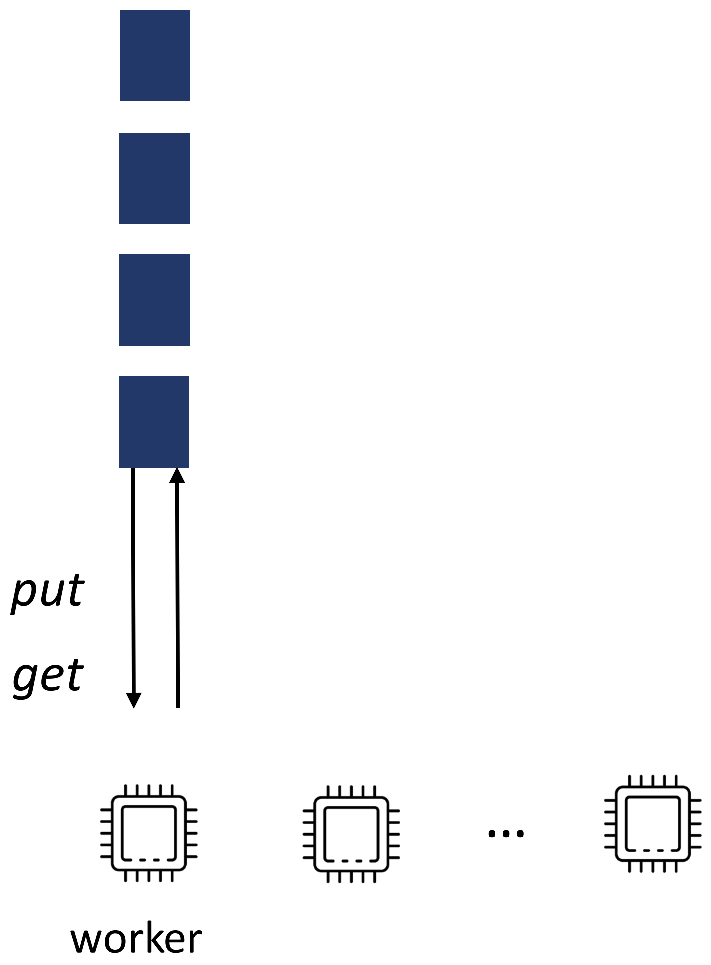
BWoS [OSDI’23]:
- Thieves can’t steal from the block where the owner is
  (Bad performance in specific scenarios)

Our Solution: Partial Asynchronous Delegation



Using the block-based design [ATC'22, OSDI'23] to avoid contention

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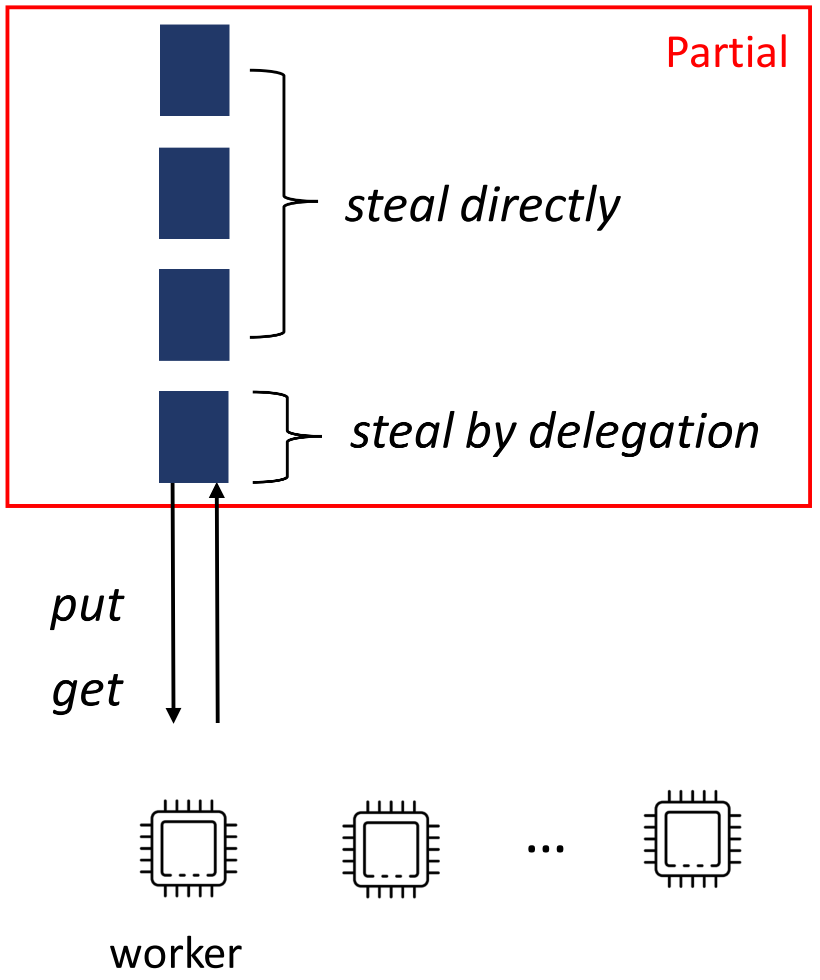

Using the block-based design [ATC'22, OSDI'23] to avoid contention

Partial:
- Delegation is enabled only for the block where the owner is present
- When the owner advances to the next block, the delegation of owner's current block is closed, and the next one is opened
- Allows for stealing from the owner's block compared to BWoS

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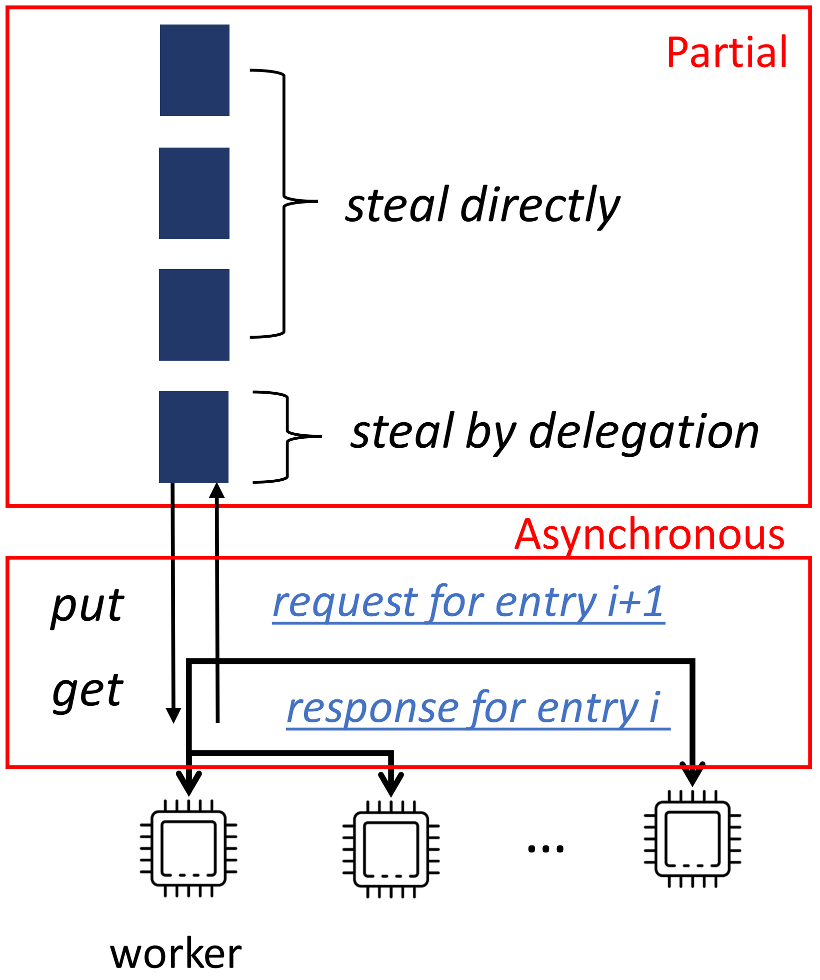

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Asynchronous:
- A steal operation requests for the next steal op.
- A thief requests entry i+1 and obtains entry i that is requested by the previous steal operation (if available) without waiting

Thanks!