Lightweight Communication Interface

A Communication Runtime for Asynchronous Task Systems

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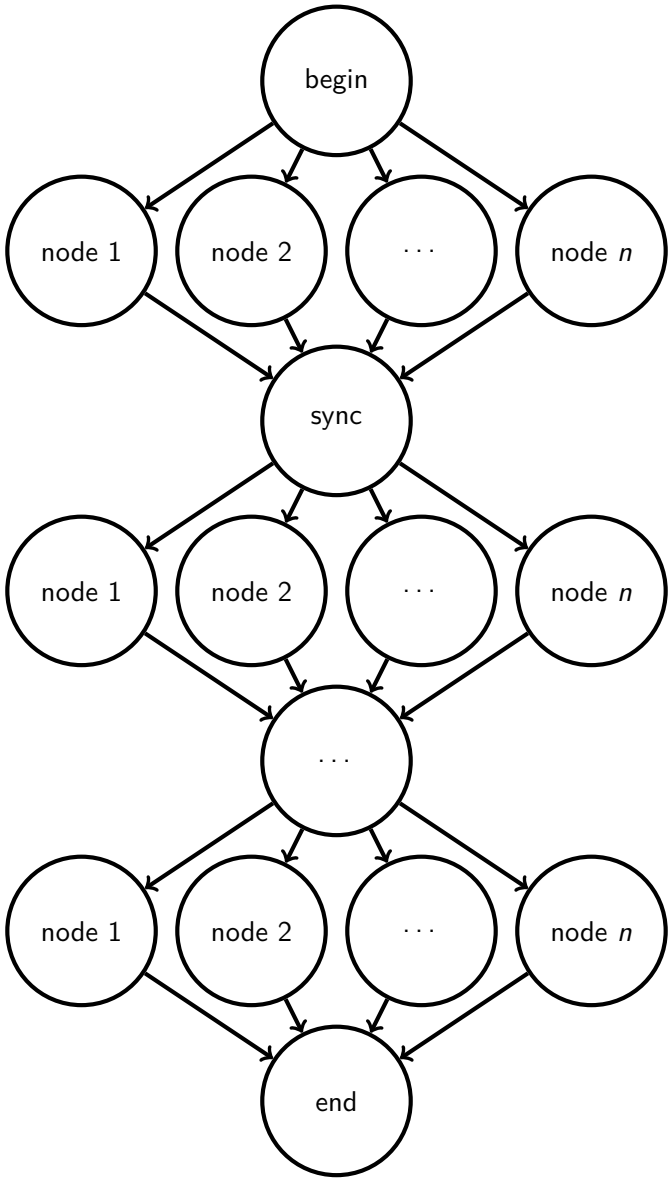
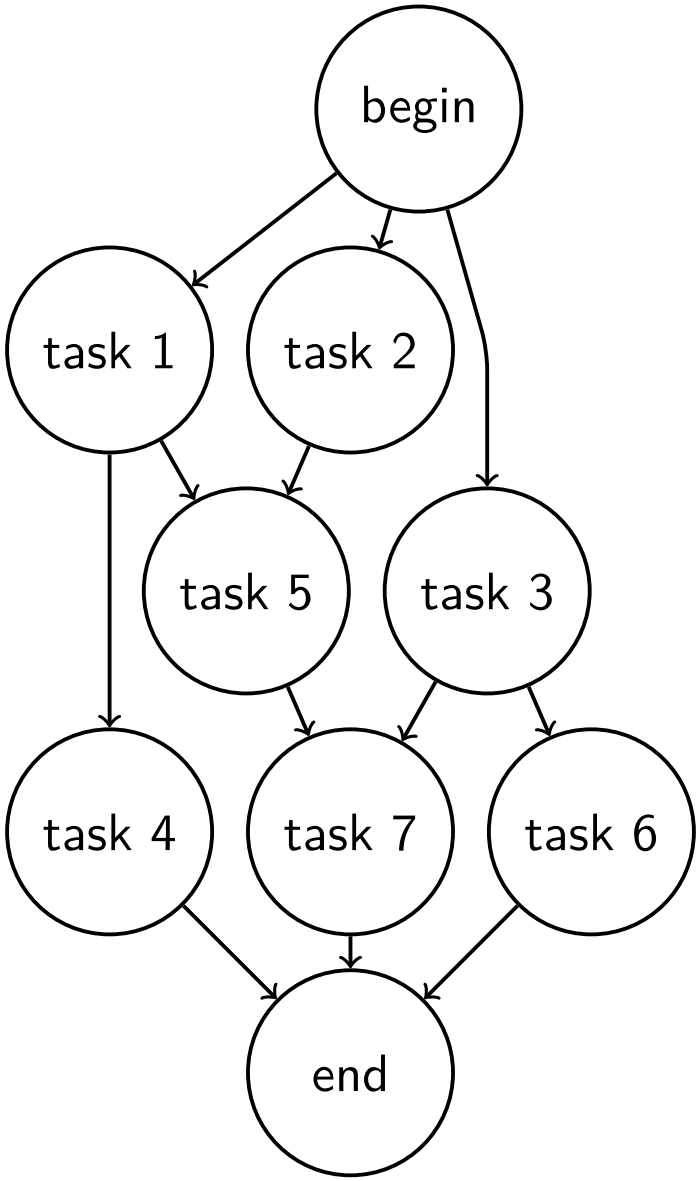
Bulk Synchronous Parallel



Asynchronous Task Systems



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- Addresses major issues:
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- Examples:
  - PaRSEC (UTK)
  - Legion (Stanford)
  - StarPU (INRIA)
  - Others...

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- Bandwidth & NIC message injection rate increasing—performance limited by the communication runtime on the CPU

Lightweight Communication Interface (LCI)

- Low-level communication runtime
- Consumed by language runtimes, frameworks, and libraries
  - Not typically used by application programmers
- Provide middleware developers as much direct control as possible
- Expose hardware performance and functionality with low overhead

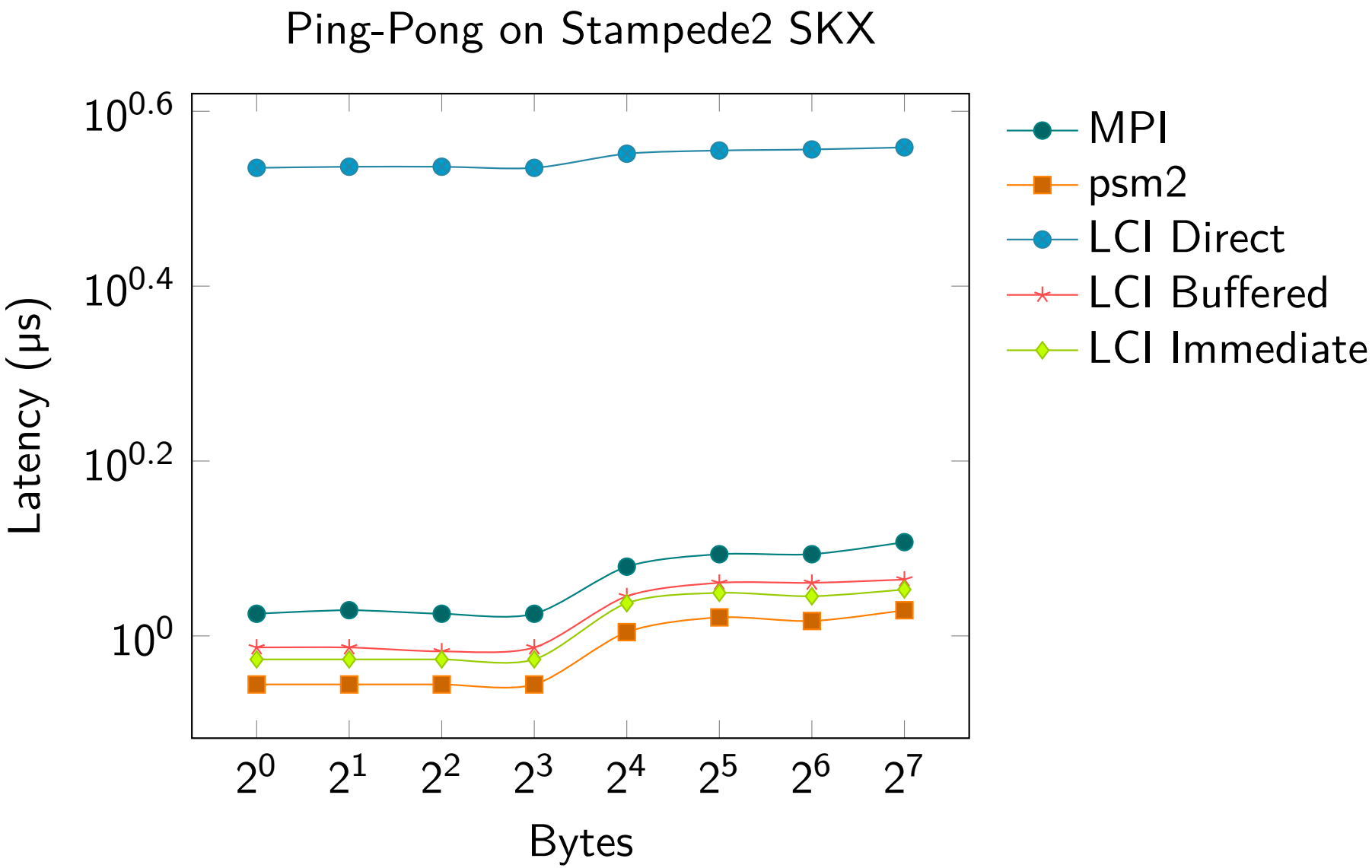
Design Goals

- Use functionality that can be directly supported by NICs
- Do *not* expose higher-level functionality
- Directly support communication paradigms of targeted frameworks
- Direct control of communication progress and memory allocation
- Efficient concurrent communication for massive parallelism
- Direct producer-consumer communication
- Split communication into independent streams

Concepts and Primitives

- *Endpoint*: handle local communication requests and completion of remote messages (group/communicator)
- *Completion*: simple synchronizers, counters, queues, and handlers
- *Back pressure*: higher-level runtime can deal with resource exhaustion
- *Protocol selection*: point-to-point communication with eager or rendezvous protocols, depending on data size
- *Progress*: explicit progress calls per-device

Performance: Latency



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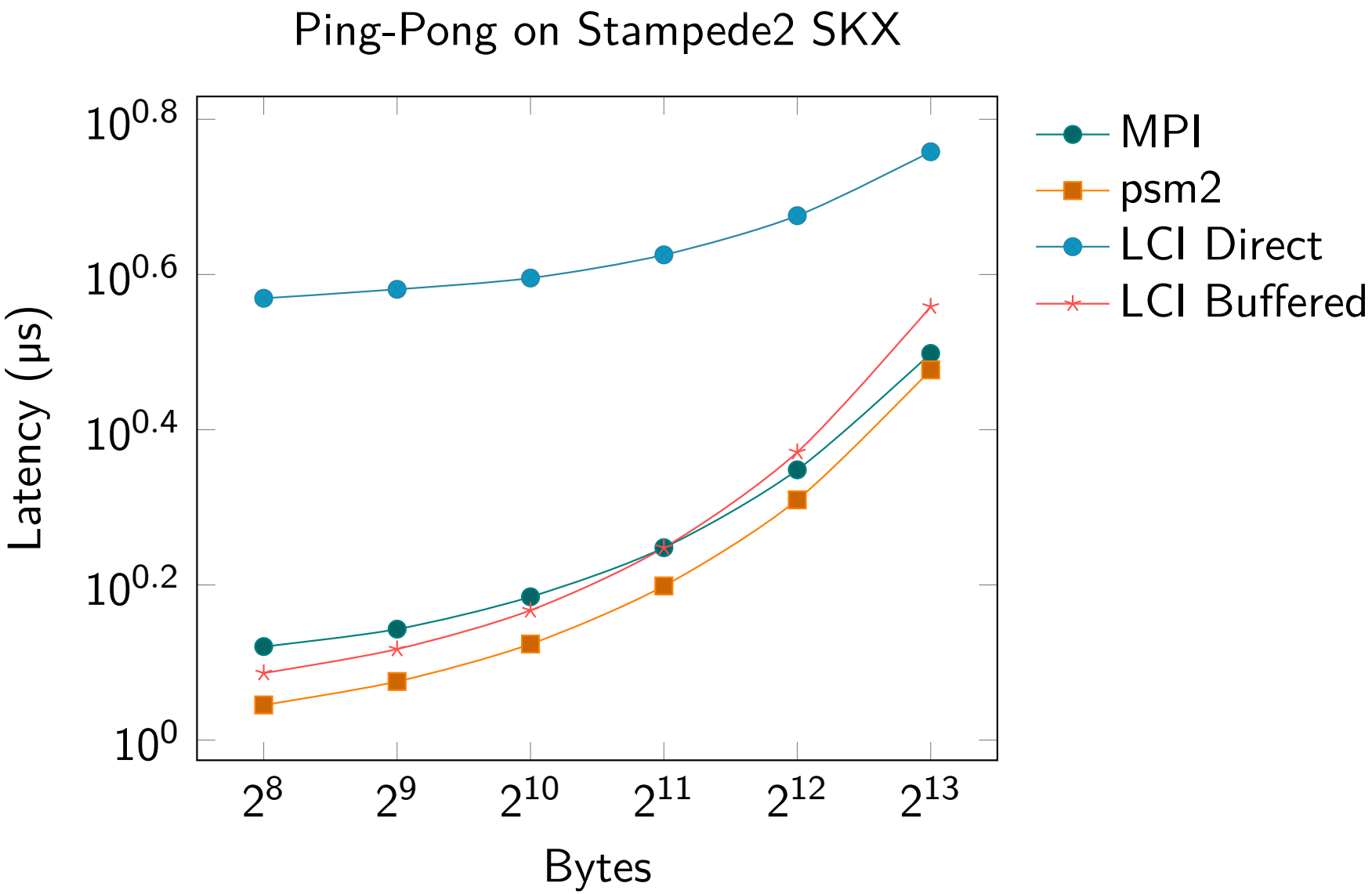

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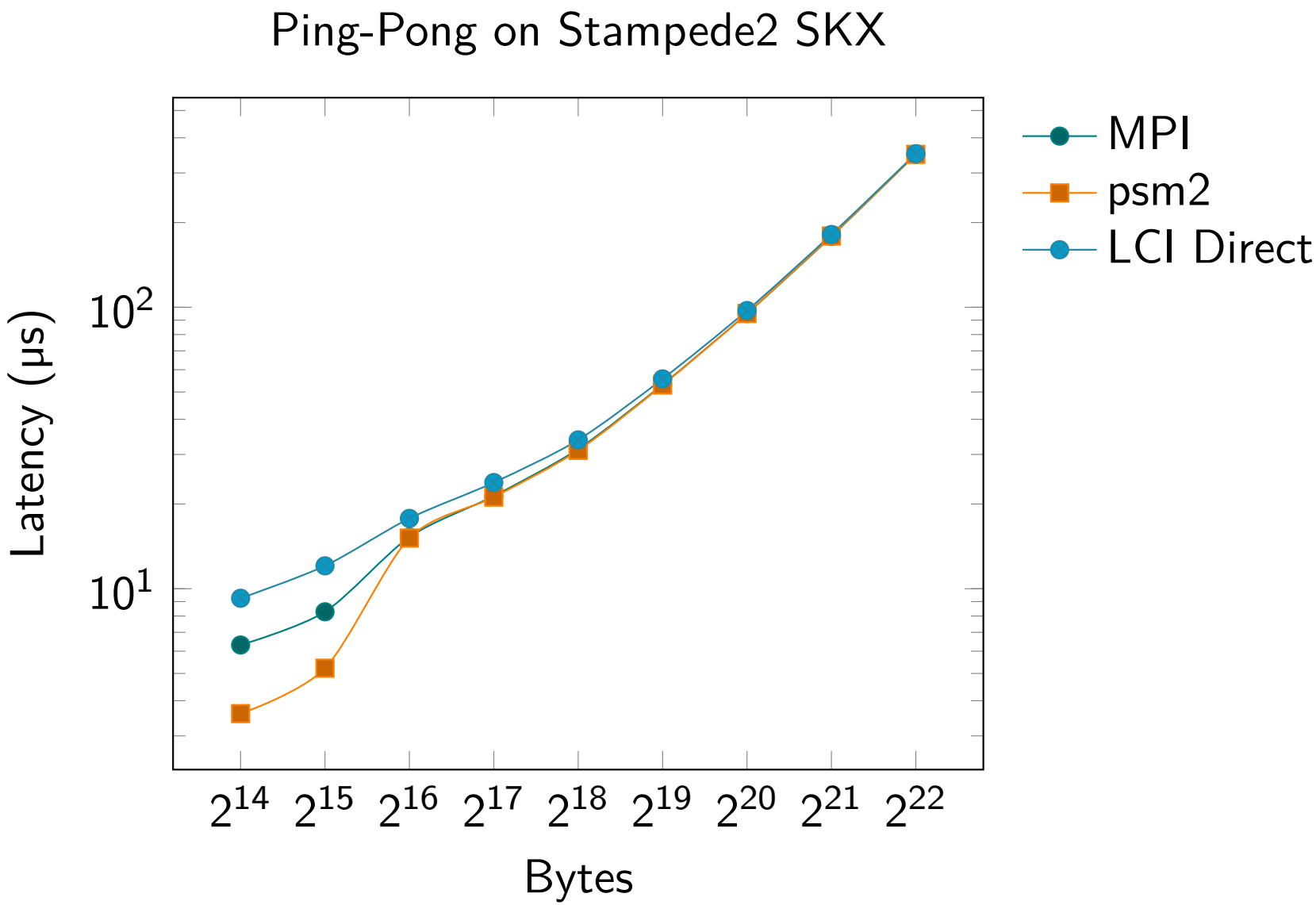
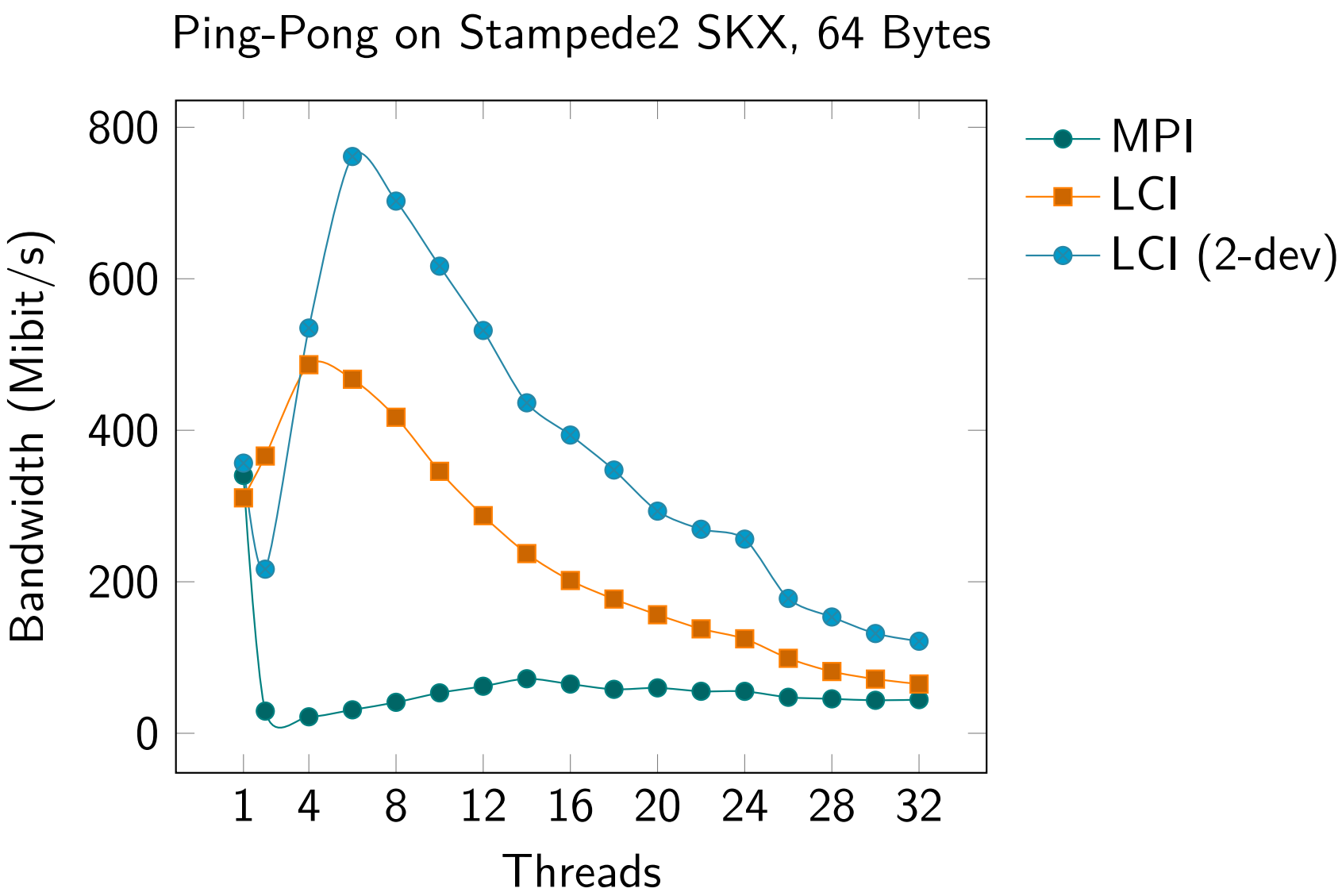


Performance: Bandwidth



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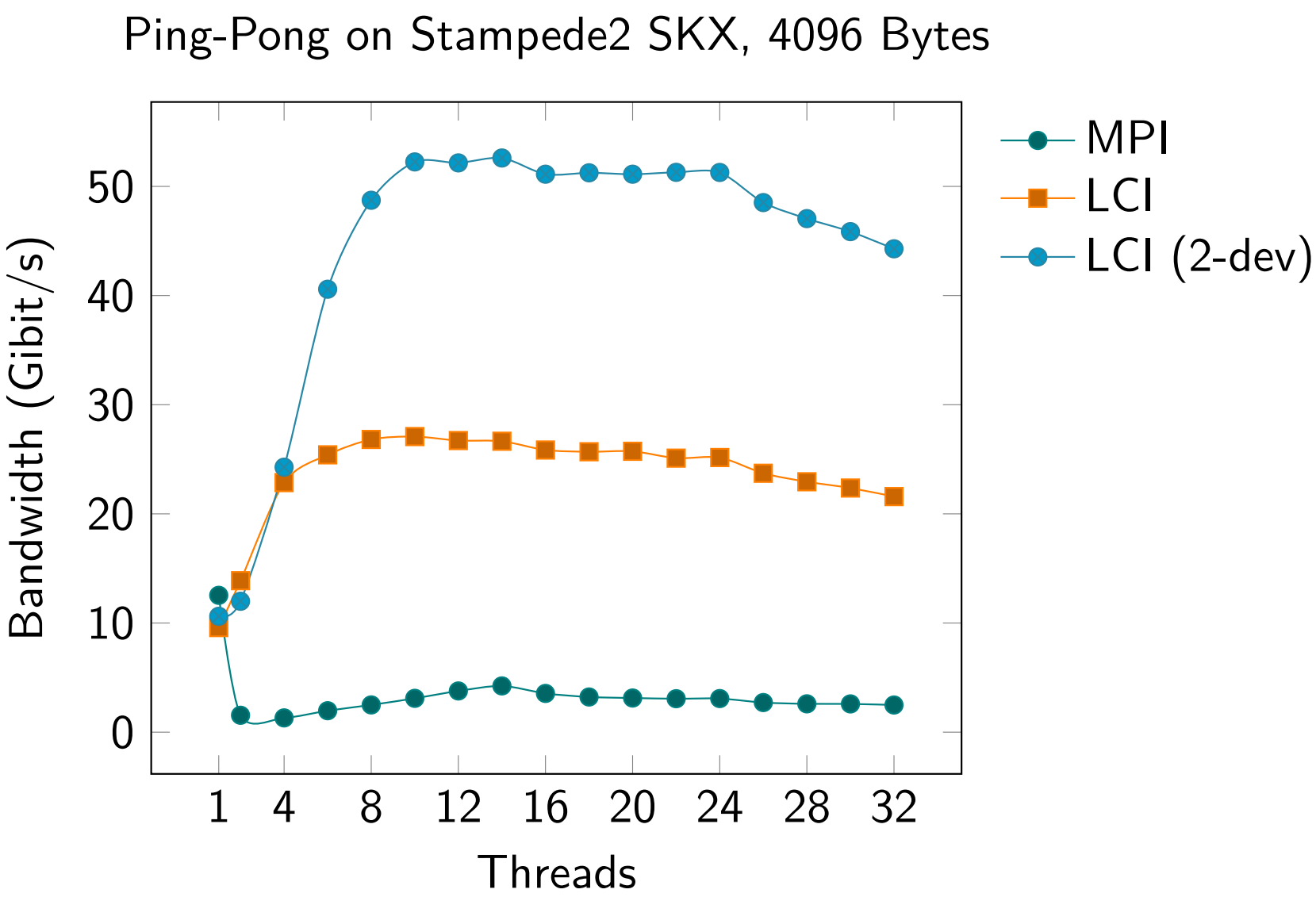

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- We welcome further collaborations!