1st Summit on Gender Equality in Computing
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Porting Distributed Data Structures to Future Many-core Architectures

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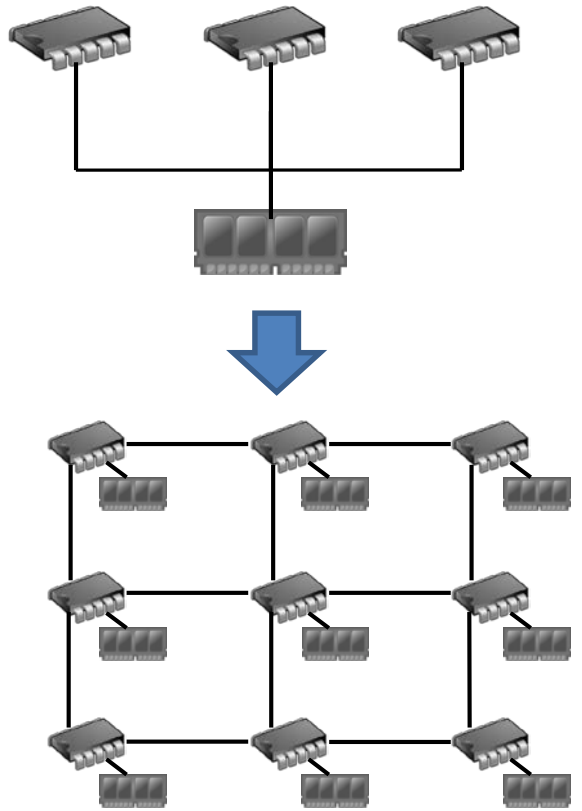
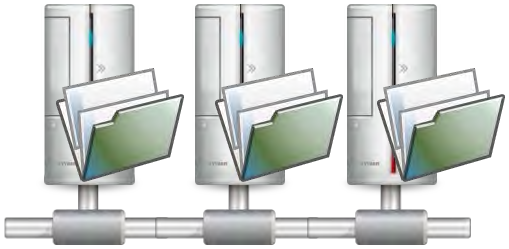
A foreseeable future in architecture

- **m islands (or clusters)**
  - each comprised of c cores
  - containing one or more processors
- **No (hardware) cache coherence**
  - main memory is split into modules
  - each module associated to a distinct island (or core)
- **Message passing.**
- **DMA is possible.**



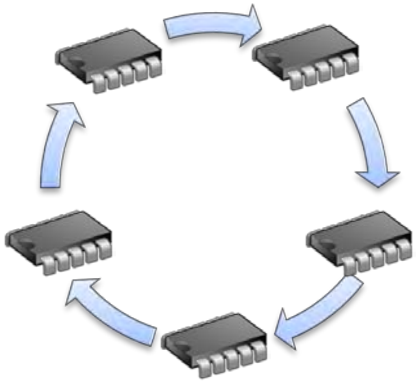
Data structures crucial for portability and productivity of software design!

Exploiting architecture characteristics



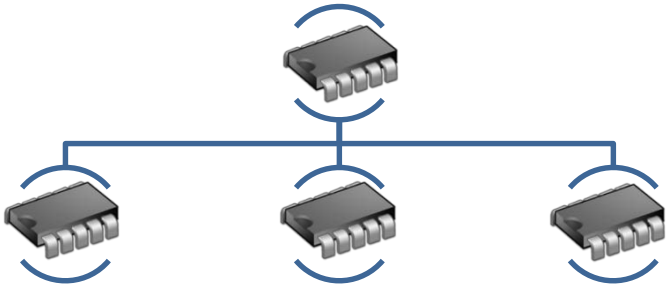
DS stored in distributed directory.

- One server acts as synchronization manager.
- Communication is distributed over the system.



DS distributed over local memories in token ring.

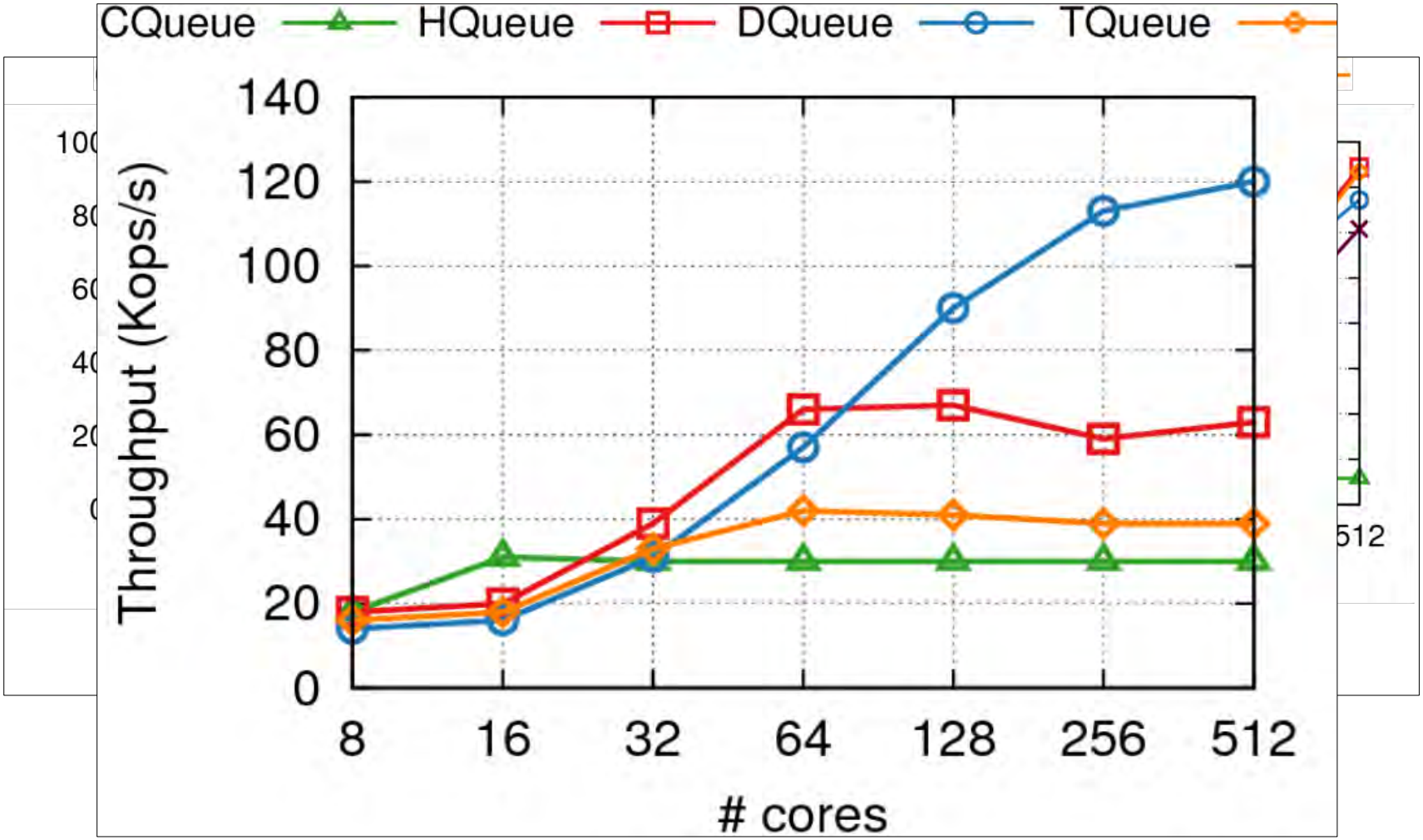
- Communication with current token server.
- When local memory fills up, token is forwarded.



Exploiting communication characteristics:

- Hierarchical design exploits fast intra-island communication.
- Requests are batched in each island and forwarded to appropriate server.

Factors that lead to good scaling



Our Contribution

→ A first step towards designing customized scalable data structures for future non cache-coherent many-core architectures.

- We studied techniques for implementing distributed DS for many-core architectures.
  - Challenges:
    - *Non or partially cache-coherent memory*
    - *Message-passing paradigm*
- We combined variants of these techniques to design a rich collection of DS
  - *stacks, queues, dequeues, lists, sets*
- This collection could be utilized by high-productivity languages
  - *Easy porting to new and future architectures!*
  - *Collection can be used as library even by non-experts*
- Our experiments illustrate the scalability power of the hierarchical approach.