Evaluation and Driving Applications for On-Chip Networks

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Workloads

- Environments: Traditional multi-core, SoC

- Apps

  – Running on desktops/laptops: traditional, gaming

  – HPC: real time simulation, bioinformatics, financial, other traditional apps

  – Datacenter: TPC, server consolidation

  – Recognition, Mining, Synthesis

  – Healthcare: MRI, etc.

  – Embedded (SoC-type): handheld games, medical

Architectural Characterization

- Access patterns: memory, I/O, streaming

- sharing: read/write, read only, etc.

- Synchronization: fine/coarse grain, collective

- QoS, need for real time guarantees, performance isolation, isolation for security

- Programming models

    - Mixed mode (msg passing + coherence/shared memory)

    - programming issues with new memory hierarchies being exposed to programmer

Network Requirements

- Support
  - granularity of data transfers
  - synchronization (multicast, etc.) and collective operations
  - Partitioning: QoS (virtual channels, partitioning), performance isolation, isolation for security
- Network interfaces for different protocols

Evaluation Metrics

- latency, b/w under different traffic classes

- power / energy thermal constrained?

- area, constrained

- real time deadlines, QoS (esp for SoC)

- standardization of metrics

- Monitoring/counters under constraints

Research Issues

- New programming models

  – performance aware constructs and annotations

- Limits to scalability of coherence protocols (enhanced support for barriers, multicast)

- Network support for classes of traffic

- New types of network services

  – isolation, security, partitioning, error recovery, power-aware decisions, reconfiguration, ...

- Models for RT guarantees (for SoC)

- Architectural benchmark suites & characterization

Tools/Methodolgy

- Tools and methodology
  - modeling
  - simulation: trace, execution, full-system simulation
  - emulation
  - prototyping