

CMSC 714

Lecture 8

Sun Fireplane and SGI Origin 2000

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Notes

- OpenMP assignment due Monday
 - everybody got the message about the problem with the serial code?
 - other questions?
- Need more volunteers for paper/questions
- Sample topics for group project posted soon
- Cancelled class policy

Shared Memory Multiprocessors

- Cache coherence
 - to keep different copies of same memory location (data block) the same
 - caching causes the problem, but is needed for performance
- Snooping vs. directory-based coherence
 - shared medium (bus or switched network) vs. distributed directory to keep track of shared data blocks
 - either way, all memory accesses are to local copies near a processor, and data blocks change state and move around to where they are needed
 - state of each block kept track of with a finite state machine (shared, exclusive, read-only, etc.)

SGI Origin 2000

- Scalable distributed shared memory (DSM) machine
 - from small building blocks, so scale up and down
- Each node is a dual-processor machine, with access to local memory, interconnection network and I/O system
- Nodes connected via “bristled” fat hypercube network
- Cache coherence maintained via directory that keeps track of each data block (page)
 - both the state of the cache block, and where copies are located
 - protocol appears complicated, but all implemented in hardware, so usually fast – big problem is transitioning to exclusive state for writes, to invalidate copies and TLB entries
 - supports migrating whole pages across nodes, with OS help
- Memory system includes support for fetch-and-op primitives, to speed up some synchronization operations
 - avoid cache coherence activity

Sun Fireplane

- Multi-level interconnection network for range of Sun SMPs
- Snooping done via both buses (at lower levels of interconnect hierarchy), and interconnection network broadcast at higher levels
- Note that tau is a SunFire 6800, as described in the paper
 - 6 4-processor boards, each with 12GB memory, fully cache coherent
- Simpler cache coherence protocol than Origin2K, because of snooping
 - even in larger configurations (Sun 15K), still a variant of snooping, with some additional support across multiple snooping domains to limit interconnect traffic