Whither Programming Models?

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How did we get here?

- Tons of work on parallel languages and models in the late 70s and 80s
- Some of it bad, but much of it good, from a conceptual point of view
- But nobody offered a really big win, and we couldn’t get good performance with good models, so we settled for good performance with poor models
And where exactly are we?

✓ Pthreads are sort of ok
✓ MPI and OpenMP are not!
   - too hard to use
   - not applicable to non-HPC-style systems

→ The challenge: come up with something better that isn’t too different for the languages we already use
   - maintain programmer comfort
   - leverage existing tools (compilers in particular)
Recommendation #1

✓ Recognize that both shared memory and message passing have a place
  - Shared memory good for passive communication
  - Message passing good for active communication
  - Much of the time you can use either (matter of taste)
  - Sometimes you need one or the other; witness
    • events in shared memory systems
    • put() and get() in message passing systems
Recommendation #2

✓ Make the easy stuff easy
  - coherent shared memory (S-DSM) for
    • fast prototyping
    • non-performance critical code
  - global address space with put() and get() for performance tuning of shared memory code
  - 2-ended message passing for active communication

- These models *can* comfortably co-exist within a single application
Recommendation #3

✔ Don’t embed HPC assumptions

- parallel computing is going mainstream --
  think immersive 3-D video games

- can’t afford to assume
  • fixed number of processes
  • single process per processor

- must accommodate
  • availability / replication
  • fault tolerance / recovery
  • language and machine heterogeneity

- potential big wins for grid computing today
Short term:

✓ Combine the convenience of S-DSM with the tunability of put() / get() and explicit messages

Longer term:

✓ Encourage research in more speculative models, and in aggressive parallelizing compilers