IPDPS 2007 Panel Position: 
Is the Multi-Core Roadmap going to Live Up to its Promises?

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## The Questions, and a Summary of My Answers

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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<td>Is the computing <strong>landscape</strong> (technology, applications, and market) today sufficiently different to exploit multiprocessors from what it was in the past? If yes, in what sense? If not, why?</td>
<td>It depends.</td>
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<td>Do we need more <strong>research in multiprocessing</strong> given past work? If yes, what are the biggest challenges? If not, state the reasons.</td>
<td>Sure.</td>
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<td>Will progress in software/architecture make it possible to make sequential <strong>languages</strong> prevail? If yes, what are the top priorities in research to make that happen?</td>
<td>Yes; see below.</td>
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<td>If not, what are the visions for a parallel-language paradigm shift and what are the major challenges in software/architecture research to accelerate uptake in the programming community?</td>
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<td>Would <strong>multi-disciplinary</strong> research (across the applications, algorithms, software, and architecture areas) be a good way to accelerate developments? Then, what areas should interact more closely and with what goals in mind?</td>
<td>It depends, but Yes.</td>
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 Dependencies

- What, exactly, is this “promise”? 
- What market(s) are we talking about? 
- Which programmers are we talking about? 
- What do you mean by “discipline”?
The Promise (My Interpretation)

- Just change the metric.
- Promise, or threat?
- Or just reality.
- We – IPDPS folks – have been working this for 30+ years.
- SMP: The most conservative form of parallelism.
- The role of demos.
Landscape

- Servers for commercial processing – OK.
  - Change:
    - All processing used to be on a monolithic mainframe.
    - Now uses multiple tiers, scales out well; back ends scale up.
  - Virtualization (partitioning) coming on strong.
    - Also helps power, space, system management.

- Clients – not OK.
  - My mind boggles at parallel Powerpoint.
  - Parallel Photoshop boggles memory.
  - Virtual worlds? Virtual World Web? vBusiness?
    - Implementations embarrassingly serial, but parallelism is there.

- HPC – Not one area. Mixed bag. **VAST** simplification:
  - Much now COTS or “COTS-like” clusters. OK, like Commercial.
  - Some: stream processing (will be mainstream). OK.
  - Rest? Either will change to one of those, or run on systems purchased like military aircraft.
Research in Multiprocessing (Hardware)

- Power, power, power. And power.
- More efficient virtualization, especially I/O.
- Synchronization that simplifies programming.
  - Possibly transactional memory?
  - No, it doesn’t help wizard programmers.
  - The wizards aren’t the ones I worry about.
- Coherent memory access: bandwidth and efficiency.
- Efficient and usable accelerator attachment.
  - now usable, or efficient, not both. (Not physics.)
  - and virtualization of accelerators.
  - and virtualization of their attachment.
- Integration of explicit data streaming with and into conventional processing units.
- Did I mention power?
An IBM Senior Vice President said:
  "I am worried."

And Lo, there came to be a Task Force.

I arrived bearing a list:
  101 active and/or well-known parallel languages.
  None with any traction in the market.
  We have Fortran, C, C++, Java. And MPI, and OpenMP.

A necessary question: What’s Wrong?
Languages & Multidisciplinary (2)

- Contrast: Commercial middleware (J2EE, SOA, DBS, etc.)
  - Key: Eliminates a huge amount of the boilerplate gruntwork. Makes the programmer’s job easier.
  - And just by the way, provides completely transparent parallelism.
  - One major reason commercial servers are OK.

- Confusion of the “answer” with the requirements
  - Nobody wants to program in parallel for the sake of parallelism.
  - Parallelism in and of itself does not simplify their jobs.
  - Want: express applications more simply, clearly, easily.

- Best: Tools which
  1. Help an application area. A lot.
     - Must do or you are toast; won’t be used.
  2. As a side effect provide parallelism.
     - E.g., not a stream programming tool/language, a CFD tool.
     - Must get inside the heads of the disciplinarians.

- Implicit: Need tools appropriate to different programmers’ roles:
  - OS, system libraries, middleware, application libraries, applications
  - Maybe these are best considered their own disciplines.
Accelerator / Architecture Longevity (Controversial!)

- Frequency growth slowdown ⇒ enhanced accelerator business case:
  - Past (45%): After 3 years – useless.
  - Now (<20%): as much 5 years useful lifetime

- Controversy? *Aggregate* chip performance still at 45%.

- Has architecture ever really mattered in the long run?
  - RISC, CISC, vector, SIMD, MIMD, whatever; who cares in 3 years?
  - Has that changed?
Thank you for listening.

Just in case any of you were wondering...
(No, I can’t give a presentation without plugging my book.)