

My Courses on Parallel & Distributed Computing

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WHAT, WHERE, and WHEN

- *VLSI Algorithmics*
Duke, UNC, and UMass (Early 1980s to late 1980s)
- *Parallel Algorithms and Architectures*
UMass (Late 1980s to mid 1990s)
- *Changing Challenges in Parallel Computing*
UMass (Mid to late 1990s)
- *Computing over the Internet*
UMass (Early 2000s)
- *Parallel/Distributed Computing on Cellular-Automata-Based Models*
UMass (Mid 2000s)

The recurring focus is:

How does the new technology impact computation? What are the new challenges?

VLSI Algorithmics

- *Sources:* Mead & Conway book, research papers
- *Sample topics:* VLSI CAD algorithms, design of systolic arrays
- *Evaluation:* Overwhelmingly positive — “theoretical CS types,” “systems types,” and engineers talked and worked together!

Parallel Algorithms and Architectures

- *Sources:* Leighton book, Leighton & Maggs book draft, research/survey papers
- *Sample topics:* Application of systolic arrays, the algorithmics of PRAMs and abstract message-passing models (characterized by topology), the increasing role of *communication* in parallel computation.
- *Evaluation:* Not so positive —
 - “Theoretical CS types” over-idealized, especially with the PRAM model.
 - “Systems types” mostly concentrated on the “low-level” picture.
(Transputers were a welcome exception.)

Changing Challenges in Parallel Computing

- *Sources*: Research/survey papers — *theory and “abstract systems”*
- *Sample topics*: Escaping the stranglehold of topology via emulations; the rise of programming abstractions: BSP and logP, CILK; the rise of clusters
- *Evaluation*: Rather negative —
 - The concerns of the “theoretical CS types” and the “systems types” had diverged.
 - The bad publicity of the PRAM era had left “Theory” with a tainted image.
 - Class projects with, e.g., BSP-Cluster and CILK-Cluster experienced “parallel slowdown.”

Computing over the Internet

- *Sources:* Research/survey papers — *theory and systems*
- *Sample topics:*
 - How can one cope with the temporal unpredictability inherent in computing over the Internet — communication plus loose coupling of computing agents?
 - How can one cope with untrusted computing agents? (collusion, Sybil attacks)
- *Evaluation:* Rather positive —
 - “Theoretical CS types” and “systems types” were addressing similar problems — and each was noticing the contributions of the other.
 - The transition away from multiprocessors, coupled with the curative properties of time, made the taint of the PRAM era fade in peoples’ memories.

Parallel/Distributed Computing on Cellular-Automata-Based Models

- *Sources:* Research/survey papers — *theory and AI and systems and engineering*
- *Sample topics:*
 - What kinds of applications can benefit from this hybrid of parallel and distributed computing? (Kivasystems)
 - How can one cope with the “semi-synchronous” nature of large physically proximate arrays — algorithms, programming languages, design? (the CARPET programming environment)
- *Evaluation:* Very positive —
“Theoretical CS types” and “systems types” and “AI types” were addressing similar problems — and each was noticing the contributions of the other. We tried to solve problems *together*.