TRAVELING THREADS: A NEW MULTITHREADED EXECUTION MODEL

APPENDICES

A Dissertation

Submitted to the Graduate School
of the University of Notre Dame
in Partial Fulfillment of the Requirements
for the Degree of

Doctor of Philosophy

by

Richard Cameron Murphy, M.S., B.S., B.A.

Peter M. Kogge, Director

 Graduate Program in Computer Science and Engineering
Notre Dame, Indiana
June 2006
FULL BENCHMARK CHARACTERISTIC DATA

Figure 1. Individual Benchmark Instruction Mixes for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e) Suites. (Continued on the next page.)
Figure 1 (continued) Individual Benchmark Instruction Mixes for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e) Suites.
Figure 2. Individual Benchmark Working Set Miss Rates for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e-h) Suites. (Continued on the next page.)
Figure 2 (continued) Individual Benchmark Working Set Miss Rates for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e-h) Suites.
Figure 3. Individual Benchmark Working Set Bytes/Flop for the Sandia (a) and SPEC-FP (b,c) suites
Figure 4. Individual Benchmark Spatial Locality Results for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e-h) Suites. (Continued on the next page.)
Figure 4 (continued) Individual Benchmark Spatial Locality Results for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e-h) Suites.
Figure 5. Individual Benchmark Spatial Locality Overhead Results for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e-h) Suites. (Continued on the next page.)
Figure 5 (continued) Individual Benchmark Spatial Locality Overhead Results for the Sandia Integer (a), Sandia Floating Point (b), SPEC Integer (c,d), and SPEC Floating Point (e-h) Suites.
Figure 6. Topological Layering for the Sandia Floating Point Benchmark Suite. (Continued on the next page).
Figure 6 (continued) Topological Layering for the Sandia Floating Point Benchmark Suite.
Figure 7. Topological Layering for the Sandia Integer Benchmark Suite. (Continued on the next page.)
Figure 7 (continued) Topological Layering for the Sandia Integer Benchmark Suite.
Figure 8. Sandia Floating Point Suite Indegree Histogram. (Continued on the next page.)
Figure 8 (continued) Sandia Floating Point Suite Indegree Histogram.
Figure 9. Sandia Integer Suite Indegree Histogram. (Continued on the next page.)
Figure 9 (continued) Sandia Integer Suite Indegree Histogram.
Figure 10. Sandia Floating Point Suite Outdegree Histogram. (Continued on the next page.)
Figure 10 (continued) Sandia Floating Point Suite Outdegree Histogram.
Figure 11. Sandia Integer Suite Outdegree Histogram. (Continued on the next page.)
Figure 11 (continued) Sandia Integer Suite Outdegree Histogram.
Figure 12. Sandia Floating Point Suite Use Distance Histogram. (Continued on the next page.)
Figure 12 (continued) Sandia Floating Point Suite Use Distance Histogram.
Figure 13. Sandia Integer Suite Use Distance Histogram. (Continued on the next page.)
Figure 13 (continued) Sandia Integer Suite Use Distance Histogram.
Figure 14. BLAST Thread Properties (Continued on the next page.)
Figure 14 (continued) BLAST Thread Properties (Continued on the next page.)
Figure 14 (continued) BLAST Thread Properties
Figure 15. Chaco Thread Properties (Continued on the next page.)
Figure 15 (continued) Chaco Thread Properties (Continued on the next page.)
Figure 15 (continued) Chaco Thread Properties
Figure 16. CTH 2gas Thread Properties (Continued on the next page.)
Figure 16 (continued) CTH 2gas Thread Properties (Continued on the next page.)
Figure 16 (continued) CTH 2gas Thread Properties
Figure 17. CTH AMR Thread Properties (Continued on the next page.)
Figure 17 (continued) CTH AMR Thread Properties (Continued on the next page.)
Figure 17 (continued) CTH AMR Thread Properties
Figure 18. CTH EFP Thread Properties (Continued on the next page.)
Figure 18 (continued) CTH EFP Thread Properties (Continued on the next page.)
Figure 18 (continued) CTH EFP Thread Properties
Figure 19. Cube3 CRS Thread Properties (Continued on the next page.)
Figure 19 (continued) Cube3 CRS Thread Properties (Continued on the next page.)
Figure 19 (continued) Cube3 CRS Thread Properties
Figure 20. Cube3 VBR Thread Properties (Continued on the next page.)
Figure 20 (continued) Cube3 VBR Thread Properties (Continued on the next page.)
Figure 20 (continued) Cube3 VBR Thread Properties

(g) Cube3 VBR Median Consumer Synchs/Thread

(h) Cube3 VBR Median Producer Synchs/Thread

(i) Cube3 VBR Mean Synchs/Inst

(j) Cube3 VBR Median Producer Synchs/Inst
Figure 21. DFS Thread Properties (Continued on the next page.)
Figure 21 (continued) DFS Thread Properties (Continued on the next page.)
Figure 21 (continued) DFS Thread Properties
Figure 22. Isomorphism Thread Properties (Continued on the next page.)
Figure 22 (continued) Isomorphism Thread Properties (Continued on the next page.)
Figure 22 (continued) Isomorphism Thread Properties
Figure 23. kMetis Thread Properties (Continued on the next page.)
Figure 23 (continued) kMetis Thread Properties (Continued on the next page.)
Figure 23 (continued) kMetis Thread Properties
Figure 24. LMP Chain Thread Properties (Continued on the next page.)
Figure 24 (continued) LMP Chain Thread Properties (Continued on the next page.)
Figure 24 (continued) LMP Chain Thread Properties
Figure 25. LMP LJ Thread Properties (Continued on the next page.)
Figure 25 (continued) LMP LJ Thread Properties (Continued on the next page.)
Figure 25 (continued) LMP LJ Thread Properties
Figure 26. SP Thread Properties (Continued on the next page.)
Figure 26 (continued) SP Thread Properties (Continued on the next page.)
Figure 26 (continued) SP Thread Properties
Figure 27. zChaff Thread Properties (Continued on the next page.)
Figure 27 (continued) zChaff Thread Properties (Continued on the next page.)
Figure 27 (continued) zChaff Thread Properties
Figure 28. sPPM Thread Properties (Continued on the next page.)
Figure 28 (continued) sPPM Thread Properties (Continued on the next page.)
Figure 28 (continued) sPPM Thread Properties

(g) sPPM Median Consumer Synchs/Thread

(h) sPPM Median Producer Synchs/Thread

(i) sPPM Mean Synchs/Inst

(j) sPPM Median Producer Synchs/Inst
FULL DATA PARTITIONING RESULTS

Figure 29. BLAST Data Transition Graph Partitioning
Figure 30. Chaco Data Transition Graph Partitioning

Figure 31. CTH 2gas Data Transition Graph Partitioning
Figure 32. CTH AMR Data Transition Graph Partitioning

Figure 33. CTH EFP Data Transition Graph Partitioning
Figure 34. Cube3 CRS Data Transition Graph Partitioning

Figure 35. Cube3 VBR Data Transition Graph Partitioning
Figure 36. DFS Data Transition Graph Partitioning

Figure 37. Isomorphism Data Transition Graph Partitioning
Figure 38. kMetis Data Transition Graph Partitioning

Figure 39. LMP Chain Data Transition Graph Partitioning
Figure 40. LMP LJ Data Transition Graph Partitioning

Figure 41. SP Data Transition Graph Partitioning
Figure 42. zChaff Data Transition Graph Partitioning

Figure 43. sPPM Data Transition Graph Partitioning
Figure 44. Sandia Floating Point Suite Thread Migration. (Continued on the next page.)
Figure 44 (continued) Sandia Floating Point Suite Thread Migration.
Figure 45. Sandia Integer Suite Thread Migration. (Continued on the next page.)
Figure 45 (continued) Sandia Integer Suite Thread Migration.