In order to deliver high computational throughputs through parallelism detection, the data-flow approach has been demonstrated. While conventional explicit parallelism approaches can sometimes show high performance, they require a focused effort on the part of the programmer in order to understand and describe the parallelism of the programmed problem. On the other hand, the functional programming approach allows the implicit detection of parallelism at runtime. At the same time, only a fraction of the programming effort needs to be expended. This shows that one of the main advantages brought by a data-flow architecture is its *programmability* which, in turn, translates into *higher performance for a given amount of programming effort.* In addition, the approach is completely scalable and the configuration of the multiprocessor systems can be adapted to the size of the application. On the other hand, the runtime scheduling of instructions imposes overhead on regular operations and lowers the expectable performance. This expected loss of performance has been traced to the high level of resolution (small granularity) which has been adopted by many data-flow projects. In a signal processing application, the regularity of the low level of processing makes it more appropriate to design a system with multiple levels of resolution. Indeed, we have demonstrated here an architecture with two hierarchy constructs. The lowest consists in a layer of vector processors while the highest provides a true data-flow approach. Future research will study how multiple layers could even include systolic arrays as leaf processors for dedicated applications. These would then be included into multiple hierarchy systems.

In summary, it can be said that the data-driven principles of execution are a necessity in the design of multiprocessor systems, be they incorporated at design, compile, or runtime. The granularity of the scheduling model often presents a tradeoff between delivering maximum amounts of parallelism and reducing communication costs.

Acknowledgment

The author would like to gratefully acknowledge the many helpful suggestions for improvement made by the anonymous referees.

References

[1] W. B. Ackerman, "Data-flow languages," in *Proc. 1979 Nat. Computer Conf.* (New York, NY, June 4–7), vol. 48. Arlington, VA: AFIPS Press, 1979, pp. 1087–1095.

[2] D. A. Adams, "A computation model with data flow sequencing," Tech. Rep. CS117, Comput. Sci. Dep., Stanford Univ., Stanford, CA, Dec. 1968.

[3] J. Allen, "Computer architecture for digital signal processing," *Proc. IEEE*, vol. 73, no. 5, pp. 852–873, May 1985.

[4] Arvind and K. P. Gostelow, "The U-interpreter," *IEEE Computer*, vol. 15, no. 2, pp. 42–48, Feb. 1982.

[5] Arvind and R. A. Iannucci, "Two fundamental issues in multiprocessing: The dataflow solutions," MIT Laboratory for Computer Science, Tech. Rep. MIT/LCS/TM-241, Sept. 1983.

[6] Arvind, V. Kathil, and K. Pingali, "A processing element for a large multiprocessor dataflow machine," in *Proc. Int. Conf. on Circuits and Computers* (New York, NY, Oct. 1980). New York, NY: IEEE, 1980.

[7] Arvind and R. E. Thomas, "I-Structures: An efficient data type for functional languages," Rep. LCS/TM-178, Lab. for Computer Science, MIT, June 1980.

[8] E. A. Ashcroft and W. W. Wadge, "LUCID, A nonprocedural language with iteration," *Commun. ACM*, vol. 20, no. 7, pp. 519–526, July 1977.

[9] J. Backus, "Can programming be liberated from the von Neumann style? A functional style and its algebra of programs," *Commun. ACM*, vol. 21, no. 8, pp. 613–641, Aug. 1978.

[10] S. D. Brookes, C. A. R. Hoare, and A. W. Roscoe, "A theory of communicating sequential processes," *J. Assoc. Comput. Mach.*, vol. 31, no. 3, pp. 560–599, 1984.

[11] D. D. Chamberlin, "Parallel implementation of a single-assignment language," Ph.D. dissertation, Stanford Univ., Computer Science Dept., 1971.

[12] M. Chase, "A pipelined data flow architecture for digital signal processing: The NEC μPD7281," in *IEEE Workshop on Signal Processing*, Nov. 1984.

[13] J. B. Dennis, "Data-flow supercomputers," *Computer*, pp. 48–56, Nov. 1980.

[14] ——, "First version of a data flow procedure language," in *Programming Symp.: Proc. Colloque sur la Programmation* (Paris, France, Apr. 1974), B. Robinet, Ed., *Lecture Notes in Computer Science*, vol. 19. New York, NY: Springer-Verlag, 1974, pp. 362–376.

[15] J. B. Dennis and K.-S. Weng, "An abstract implementation for concurrent computation with streams," in *Proc. 1979 Int. Conf. on Parallel Processing*, pp. 35–45, Aug. 1979.

[16] A. Di Cenzo, "Synthetic aperture radar and digital processing: An introduction," *JPL Publication 80-90*, Feb. 15, 1981.

[17] D. D. Gajski, D. A. Padua, D. J. Kuck, and R. H. Kuhn, "A second opinion on data-flow machines and languages," *IEEE Computer*, vol. 15, pp. 58–69, Feb. 1982.

[18] J. L. Gaudiot, "Structure handling in data-flow systems," *IEEE Trans. Comput.*, vol. C-35, pp. 489–502, June 1986.

[19] J. L. Gaudiot, M. Dubois, L. T. Lee, and N. Tohme, "The TX16: A highly programmable multi-microprocessor architecture," *IEEE Micro*, vol. 6, pp. 18–31, Oct. 1986.

[20] J. L. Gaudiot and M. D Ercegovac, "Performance evaluation of a simulated data-flow multicomputer with low resolution actors," *J. Parallel and Distributed Comput.* New York, NY: Academic Press, Dec. 1985.

[21] J. L. Gaudiot, R. W. Vedder, G. K. Tucker, D. Finn, and M. L. Campbell, "A distributed VLSI architecture for efficient signal and data processing," *IEEE Trans. Comput.*, vol. C-34, pp. 1072–1087, Dec. 1985.

[22] K. P. Gostelow and R. E. Thomas, "A view of dataflow," in *Proc. Nat. Computer Conf.* (New York, NY, June 4–7), vol. 48. Arlington, VA: AFIPS Press, 1979, pp. 629–636.

[23] J. R. Gurd, C. C. Kirkham, and I. Watson, "The Manchester data-flow computer," *Commun. ACM*, vol. 28, no. 1, pp. 34–52, Jan. 1985.

[24] I. Hartimo, K. Kronlof, O. Simula, and J. Skytta, "DFSP: A data flow signal processor," *IEEE Trans. Comput.*, vol. C-35, no. 1, pp. 23–33, Jan. 1986.

[25] K. Hiraki, T. Shimada, and K. Nishida, "A hardware design of the SIGMA-1—A data flow computer for scientific computations," in *Proc 1984 Int. Conf. on Parallel Processing*, Aug. 1984.

[26] C. A. R. Hoare, "Communicating sequential processes," *Commun. ACM*, vol. 21, no. 8, Aug. 1978.

[27] R. W. Hockney and C. R. Jesshope, *Parallel Computers.* Bristol, UK: Adam Hilger, Ltd., 1981.

[28] E. B. Hogenauer, R. F. Newbold, and Y. J. Inn, "DDSP—A data flow computer for signal processing," in *Proc. 1982 Int. Conf. on Parallel Processing*, Aug. 1982.

[29] K. Hwang and F. A. Briggs, *Computer Architecture and Parallel Processing.* New York, NY: McGraw-Hill, 1984.

[30] L. H. Jamieson and E. A. Ashcroft, "Performance analysis of dataflow signal processing algorithms," in *Proc. 1986 Int. Conf. on Parallel Processing* (St. Charles, IL, Aug. 1986), pp. 608–610.

[31] D. Johnson *et al.*, "Automatic partitioning of programs in multiprocessor systems," in *Proc. IEEE COMPCON 80* (IEEE, New York, Feb. 1980).

[32] H. T. Kung, "Why systolic archtectures?" *IEEE Computer*, vol. 15, pp. 37–46, Jan. 1982.

[33] S. Y. Kung, K. S. Arun, R. J. Gal-Ezer, and D. V. Bhaskar Rao, "Wavefront array processor: Language, architecture and applications," *IEEE Trans. Comput.*, vol. C-31, no. 11, pp. 1054–1066, Nov. 1982.

[34] S. Y. Kung, R. E. Owen, and J. G. Nash, eds., *VLSI Signal Processing II*. New York, NY: IEEE PRESS, 1986.
[35] E. A. Lee and D. G. Messerschmitt, "Static scheduling of synchronous data flow programs for digital signal processing," *IEEE Trans. Comput.*, vol. C-36, no. 1, pp. 24–35, Jan. 1987.
[36] P. Le Guernic, A. Benveniste, P. Bournai and T. Gautier, "SIGNAL—A data flow-oriented language for signal processing," *IEEE Trans. Acoust., Speech, Signal Processing*, vol. ASSP-34, pp. 362–374, April 1986.
[37] J. R. McGraw, "Data-flow computing: The VAL language," *ACM Trans. Programming Languages and Systems*, vol. 4, pp. 44–82, 1982.
[38] J. R. McGraw and S. K. Skedzielewski, "SISAL: Streams and iteration in a single assignment language, language reference manual, version 1.2," Lawrence Livermore Nat. Lab. Tech. Rep. TR M-146, Mar. 1985.
[39] D. C. Munson, J. D. O'Brien, and W. K. Jenkins, "A tomographic formulation of spotlight-mode synthetic aperture radar," *Proc. IEEE*, vol. 71, no. 8, pp. 917–925, Aug. 1981.
[40] J. H. Patel and E. H. Davidson, "Improving the throughput of a pipeline by insertion of delays," in *Proc. 3rd Ann. Symp. on Computer Architecture, pp. 159–164, Jan. 1976.*
[41] B. R. Rau, C. D. Glaeser, and R. L. Picard, "Efficient code generation for horizontal architectures: compiler techniques and architectural support," in *Proc. 9th Int. Symp. on Computer Architecture*, June 1982.
[42] J. E. Requa and J. R. McGraw, "The piecewise data flow architecture: Architectural concepts," *IEEE Trans. Comput.*, vol. C-32, pp. 425–438, May 1983.
[43] J. E. Rodriguez, "A graph model for parallel computation," TR ESL-R-398, MAC-TR-64, Lab. for Computer Science, MIT, Sept. 1969.
[44] D. A. Schwartz and T. P. Barnwell III, "Cyclo-static solutions: Optimal multiprocessor realizations of recursive algorithms," in *VLSI Signal Processing II*. New York, NY: IEEE PRESS, 1986.
[45] H. W. Sorenson, "Kalman filtering techniques," in *Advances in Control Systems*, C. T. Leondes, Ed., vol. 3, pp. 219–264, 1966.

Jean-Luc Gaudiot (Member, IEEE) was born in Nancy, France, in 1954. He received the Diplôme d'Ingénieur from the Ecole Supérieure d'Ingénieurs en Electrotechnique et Electronique, Paris, France, in 1976, and the M.Sc. and Ph.D. degrees in computer science from the University of California, Los Angeles, in 1977 and 1982, respectively.

His experience includes microprocessor systems design at Teledyne Controls, Santa Monica, CA (1979–1980) and research in innovative architectures for the TRW Technology Research Center, El Segundo, CA (1980–1982). Since graduating in 1982, he has been on the faculty of the Department of Electrical Engineering-Systems, University of Southern California, where he is currently an Assistant Professor. His research interests include data-flow architectures, fault-tolerant multiprocessors, and parallel logic programming systems. In addition to his academic duties, he has consulted for several aerospace companies in the Southern California area.

Dr. Gaudiot is a member of ACM.

Attachment 3C

OCLC WorldCat

Search WorldCat

Search

Advanced Search Find a Library

<< Return to Search Results

Cite/Export Print E-mail Share Permalink

Add to list Add tags Write a review Rate this item: 1 2 3 4 5

Proceedings of the IEEE

Author: Institute of Electrical and Electronics Engineers

Publisher: New York IEEE

Edition/Format: Journal, magazine : Periodical Computer File : English View all editions and formats

Rating: (not yet rated) 0 with reviews - Be the first.

Subjects
Elektronik.
Elektrotechnik.
Institute of Electrical and Electronics Engineers
View all subjects

More like this Similar Items

Search this publication for other articles with the following words:

Search

Get a Copy

Find a copy in the library

Find a copy online

Links to this item

sfx.ethz.ch
Online via SFX

Find a copy in the library

Enter your location: linda hall library Find libraries
Submit a complete postal address for best results.

Displaying libraries 1-6 out of 789 for all 40 editions (5109 Cherry St, Kansas City, MO 64110, USA)

Show libraries holding just this edition or narrow results by format

« First ‹ Prev 1 2 3 Next › Last »

	Library	Held formats	Distance	
1.	**Linda Hall Library** Kansas City, MO 64110 United States	Journal / Magazine / Newspaper	< 1 mile MAP IT	Library info Ask a librarian Add to favorites
2.	**University of Missouri-Kansas City** **Miller Nichols Library; Health Sciences Library; Dental Library** Kansas City, MO 64110 United States	Journal / Magazine / Newspaper	< 1 mile MAP IT	Library info Add to favorites
3.	**University of Missouri-Kansas City** **UMKC School of Law, Leon E. Bloch Law Library** Kansas City, MO 64110 United States	Journal / Magazine / Newspaper	< 1 mile MAP IT	Library info Add to favorites

4. **Kansas City Public Library**
Central Library, KCLibrary, KC Library
Kansas City, MO 64105 United States
Journal / Magazine / Newspaper — 5 miles MAP IT — Library info, Ask a librarian, Add to favorites

5. **University of Kansas**
KU Library
Lawrence, KS 66045 United States
Journal / Magazine / Newspaper — 36 miles MAP IT — Library info, Add to favorites

6. **University of Central Missouri**
James C. Kirkpatrick Library
Warrensburg, MO 64093 United States
Journal / Magazine / Newspaper — 49 miles MAP IT — Library info, Add to favorites

« First ‹ Prev 1 2 3 Next › Last »

Details

Genre/Form:	Online-Publikation Zeitschrift
Material Type:	Periodical, Internet resource
Document Type:	Journal / Magazine / Newspaper, Computer File, Internet Resource
All Authors / Contributors:	Institute of Electrical and Electronics Engineers
ISSN:	1558-2256, 0018-9219
OCLC Number:	973858925
Description:	Online-Ressource
Responsibility:	publ. monthly by the Institute of Electrical and Electronics Engineers.

Reviews

User-contributed reviews

Add a review and share your thoughts with other readers. Be the first.

Tags

Add tags for "Proceedings of the IEEE". Be the first.

Similar Items

Related Subjects: (9)

- Elektronik.
- Elektrotechnik.
- Institute of Electrical and Electronics Engineers
- NACHRICHTENTECHNIK - ALLGEMEIN
- KÖRPERSCHAFTSBERICHTE
- TÉLÉCOMMUNICATIONS - GÉNÉRAL

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.