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Duffy et al.

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(54) **PRODUCER/CONSUMER OPTIMIZATION**

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(51) **Int. Cl.**
G06F 7/00 (2006.01)
G06F 17/30 (2006.01)

(52) **U.S. Cl.** **707/713**; 707/719

(58) **Field of Classification Search** 707/713, 707/719, 999.002

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,590,319	A	12/1996	Cohen et al.
5,857,180	A	1/1999	Hallmark et al.
6,009,265	A	12/1999	Huang et al.
6,625,593	B1	9/2003	Leung et al.
6,968,335	B2	11/2005	Bayliss et al.
7,051,034	B1	5/2006	Ghosh et al.
7,146,365	B2	12/2006	Allen et al.
2005/0165798	A1	7/2005	Cherkauer et al.

OTHER PUBLICATIONS

Ganguly et al., "Query Optimization for Parallel Execution", Proceedings of the 1992 ACM SIGMOD international conference on Management of data, p. 9-18, Jun. 2-5, 1992, San Diego, California, United States.*

Graefe, "Volcano—An Extensible and Parallel Query Evaluation System", IEEE Transactions on Knowledge and Data Engineering. vol. 6, No. I. pp. 120-135, Feb. 1994, IEEE.*

Bouganim et al., "A Dynamic Query Processing Architecture for Data Integration Systems", Bulletin of the IEEE Computer Society Technical Committee on Data Engineering, 2000, IEEE.*

Bala et al., "Dynamo: a transparent dynamic optimization system", PLDI '00 Proceedings of the ACM SIGPLAN 2000 conference on Programming language design and implementation, pp. 1-12, 2000, ACM.*

Girbal et al., "Semi-Automatic Composition of Loop Transformations for Deep Parallelism and Memory Hierarchies", International Journal of Parallel Programming, vol. 34, No. 3, pp. 261-317, 2006, Spreinger Verlag Berlin Heidelberg.*

Qasem et al., "Profitable loop fusion and tiling using model-driven empirical search", ICS '06 Proceedings of the 20th annual international conference on Supercomputing, pp. 249-256, 2006, ACM.*

Pouchet aet al., "Combined Iterative and Model-driven Optimization in an Automatic Parallelization Framework", SC '10 Proceedings of the 2010 ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis, pp. 1-11, 2010, ACM.*

Ganguly, et al. "Query Optimization for Parallel Execution," Hewlett-Packard Laboratories, http://delivery.acm.org/10.1145/140000/130291/p9-ganguly.pdf?key1=130291&key2=3748847311&coll=GUIDE&dl=GUIDE&CFID=65859593&CFTOKEN=60779184, Jun. 1992, last accessed Feb. 14, 2007, 10 pages.

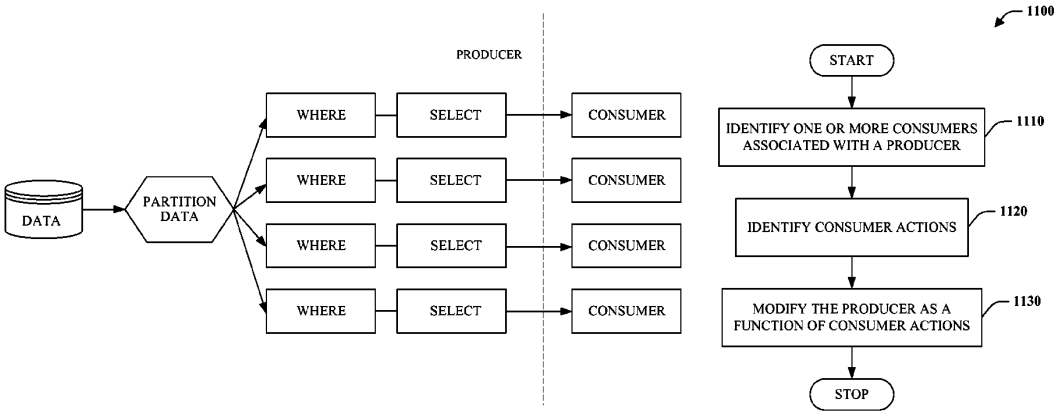
(Continued)

Primary Examiner — Michael Hicks

(57) **ABSTRACT**

Systems and methods facilitate efficient data processing in a computer environment. Data producers and consumers are considered in aggregate rather than in isolation. In one instance, interaction between data producers and consumers is improved by integrating producers and consumers. Optimization can subsequently be performed over the combination to produce synergistic results.

12 Claims, 13 Drawing Sheets



OTHER PUBLICATIONS

Lu, et al. "Optimization of Multi-Way Join Queries for Parallel Execution," Proceedings of the 17th International Conference on Very Large Data Bases, http://www.sigmod.org/vldb/conf/1991/P549.PDF, Sep. 1991, Barcelona, Spain, last accessed Feb. 14, 2007, 12 pages.

Ayres, et al. "An Extensible Query Execution Engine for Supporting New Query Execution Models," http://icwww.epfl.ch/publications/documents/IC_TECH_REPORT_2005034.pdf, last accessed Feb. 14, 2007, 16 pages.

* cited by examiner

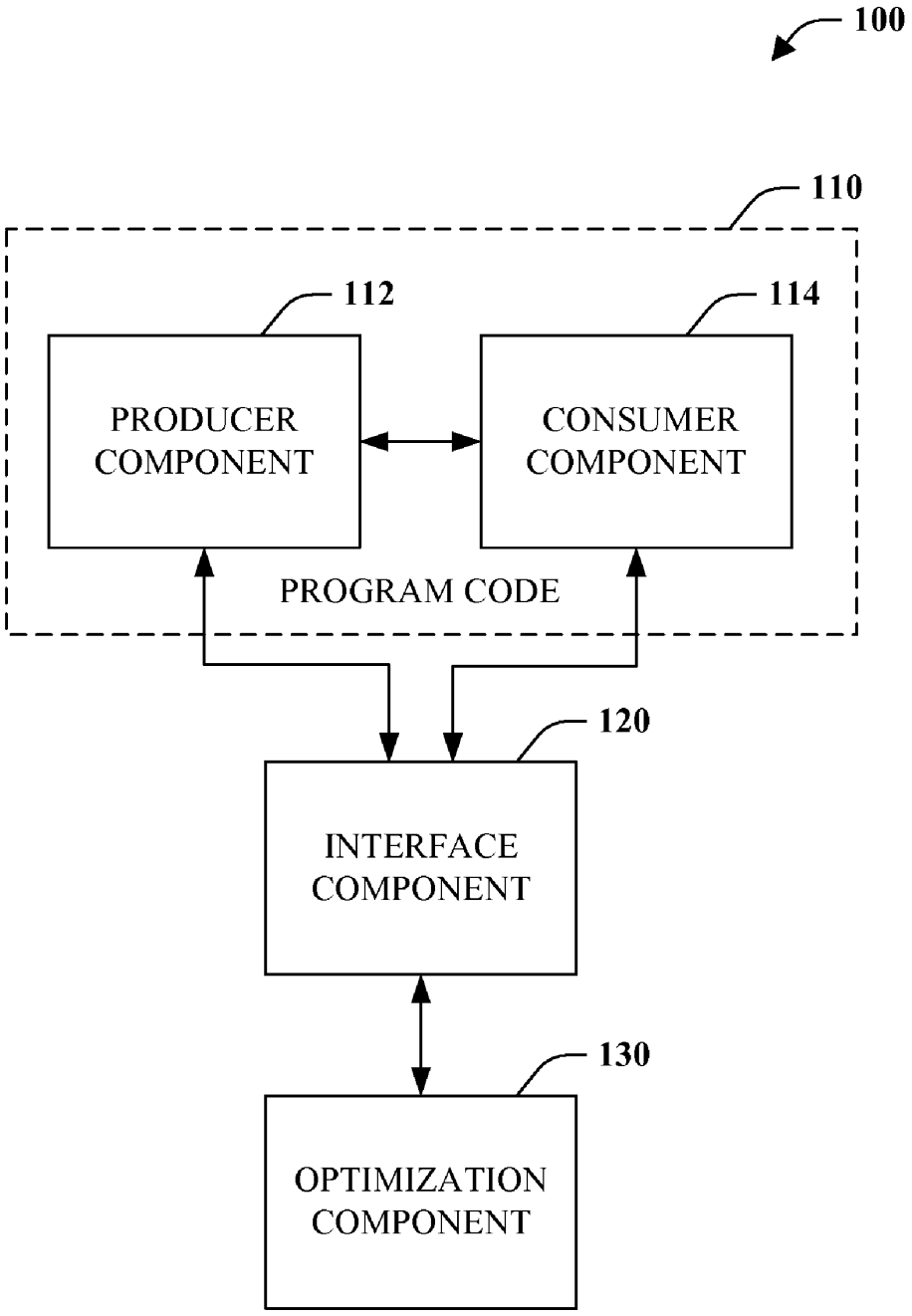


Fig. 1

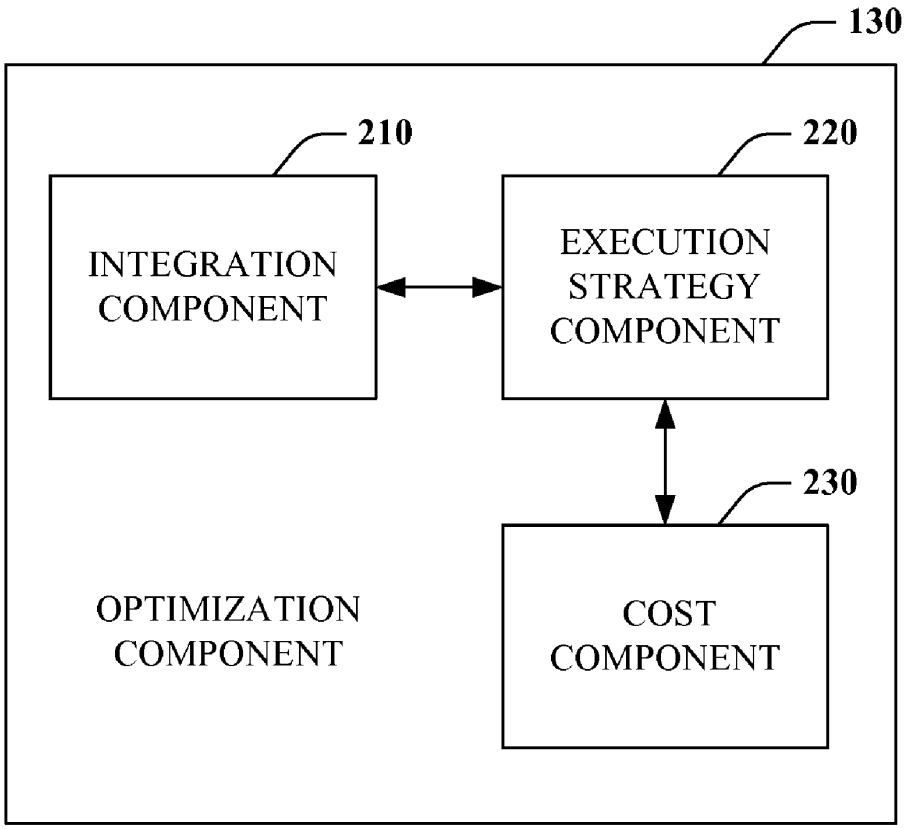


Fig. 2

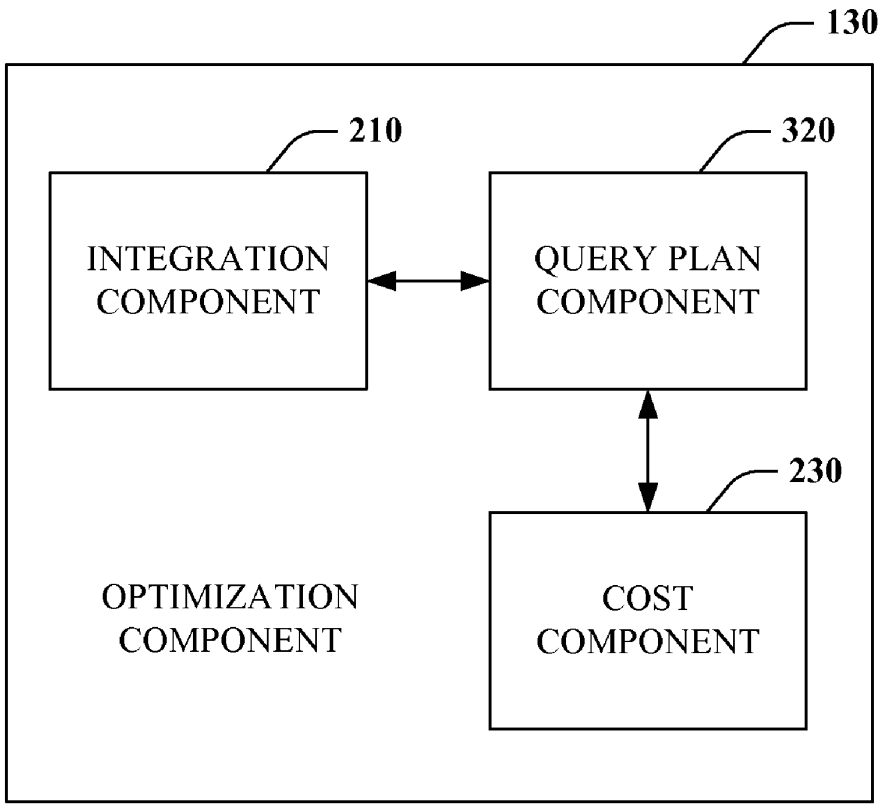


Fig. 3

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