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Poznanovic et al.

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(54) **SYSTEM AND METHOD OF ENHANCING EFFICIENCY AND UTILIZATION OF MEMORY BANDWIDTH IN RECONFIGURABLE HARDWARE**

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(51) **Int. Cl.**
G06F 12/00 (2006.01)

(52) **U.S. Cl.** **711/170; 711/154**

(58) **Field of Classification Search** **711/170-173; 712/15**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 6,076,152 A 6/2000 Huppenthal et al.
- 6,243,791 B1 * 6/2001 Vondran, Jr. 711/120
- 6,247,110 B1 6/2001 Huppenthal et al.
- 6,460,122 B1 * 10/2002 Otterness et al. 711/154
- 6,507,898 B1 * 1/2003 Gibson et al. 711/168
- 6,594,736 B1 6/2003 Parks

- 6,714,041 B1 * 3/2004 Darling et al. 326/38
- 2003/0046492 A1 * 3/2003 Gschwind et al. 711/118
- 2003/0046530 A1 * 3/2003 Poznanovic 713/100
- 2003/0084244 A1 * 5/2003 Paulraj 711/118
- 2003/0088737 A1 * 5/2003 Burton 711/118
- 2003/0208658 A1 * 11/2003 Magoshi 711/122
- 2005/0044327 A1 * 2/2005 Howard et al. 711/147

OTHER PUBLICATIONS

"Summary: The Cache Read/Write Process," The PC Guide, 2001, www.pcguid.com/ref/mbsys/cache/func.htm.*

Chien et al., "Safe and Protected Execution for the Morph/AMRM Reconfigurable Processor," IEEE, 1999, pp. 1-13.*

IEEE 100: The Authoritative Dictionary of IEEE Standards Terms, Standards Information Network, 2000, pp. 874.*

* cited by examiner

Primary Examiner—Gary Portka

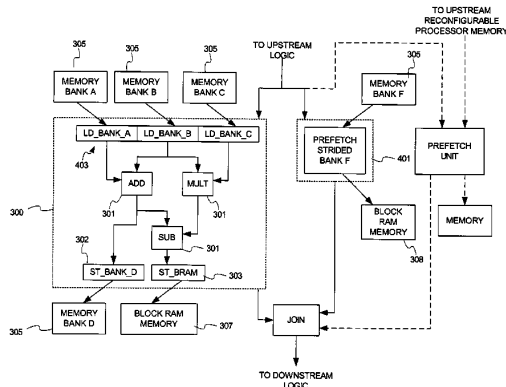
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(57) **ABSTRACT**

A reconfigurable processor that includes a computational unit and a data prefetch unit coupled to the computational unit, where the data prefetch unit retrieves data from a memory and supplies the data to the computational unit through memory and a data access unit, and where the data prefetch unit, memory, and data access unit is configured by a program. Also, a reconfigurable hardware system that includes a common memory; and one or more reconfigurable processors coupled to the common memory, where at least one of the reconfigurable processors includes a data prefetch unit to read and write data between the unit and the common memory, and where the data prefetch unit is configured by a program executed on the system. In addition, a method of transferring data that includes transferring data between a memory and a data prefetch unit in a reconfigurable processor; and transferring the data between a computational unit and the data prefetch unit.

19 Claims, 12 Drawing Sheets



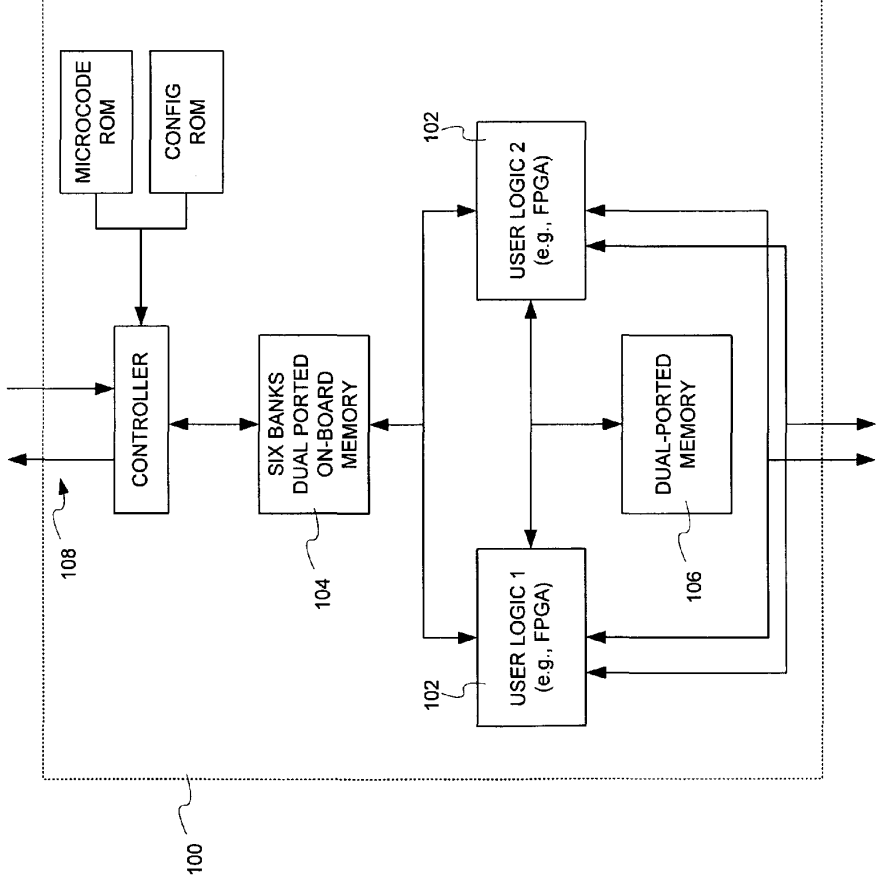


FIG. 1

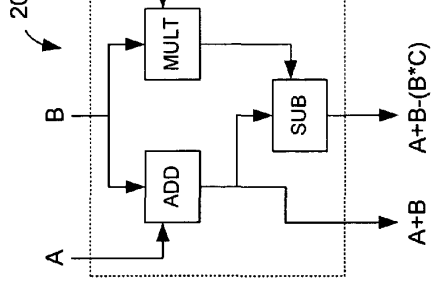


FIG. 2

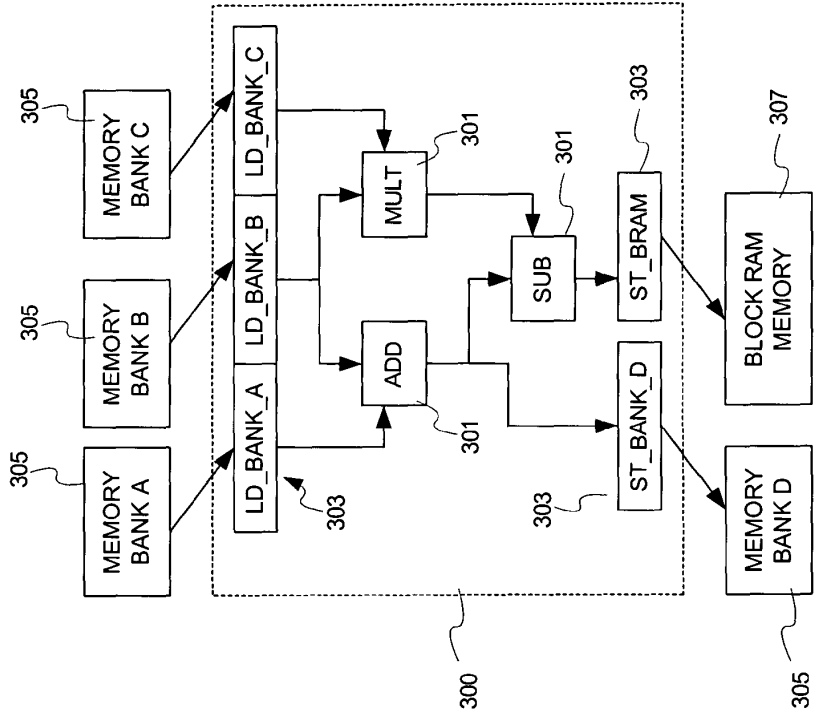


FIG. 3

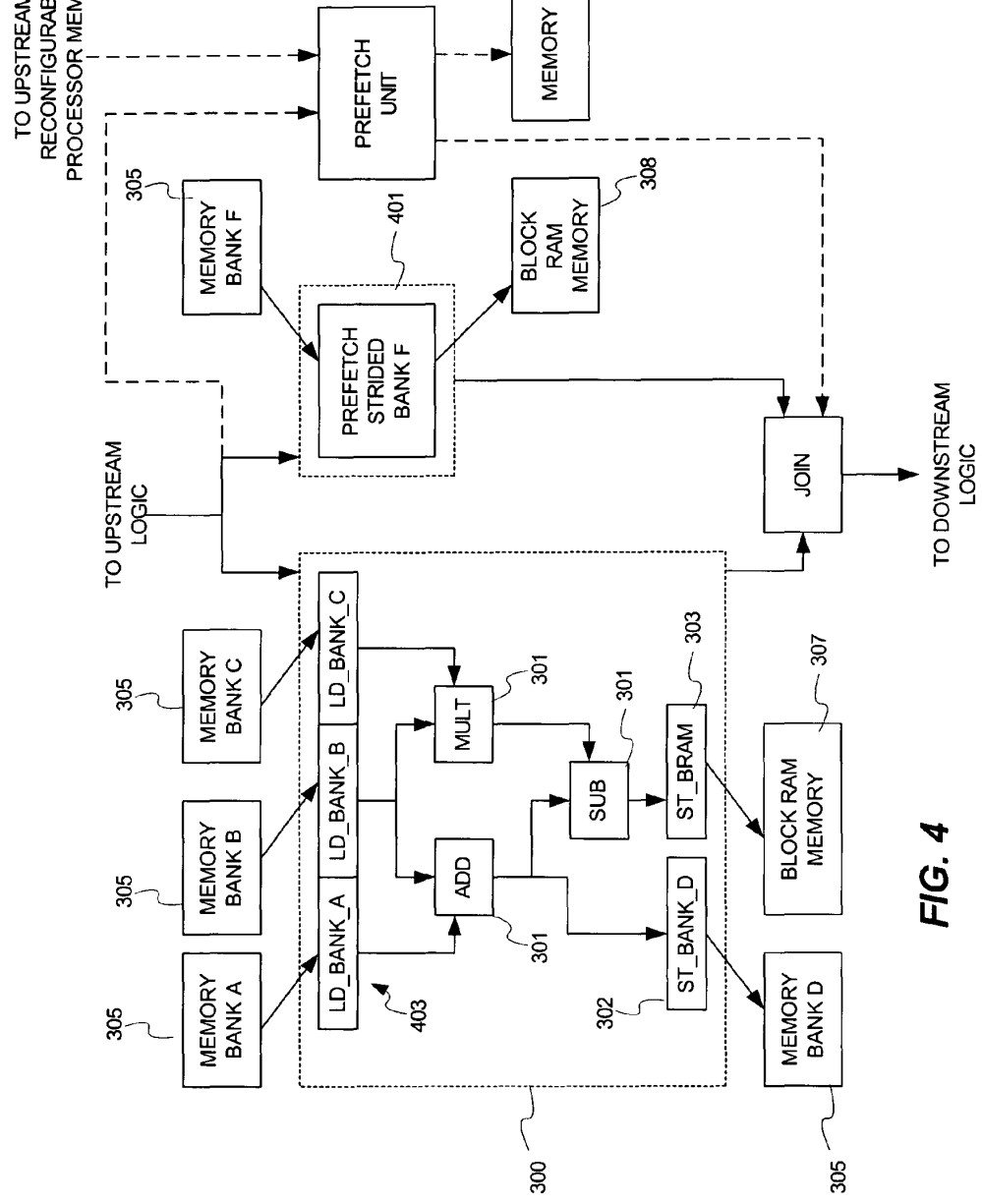


FIG. 4

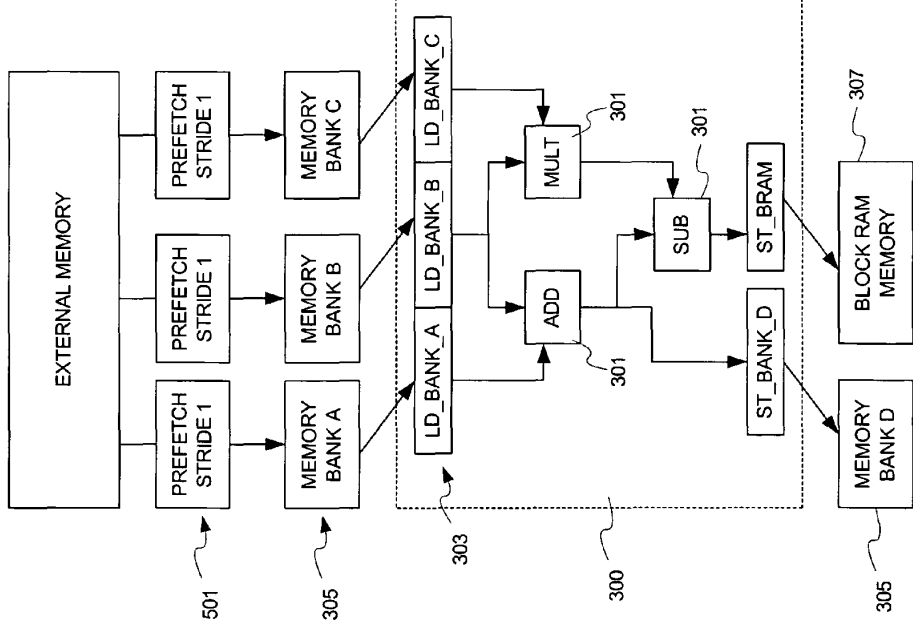


FIG. 5

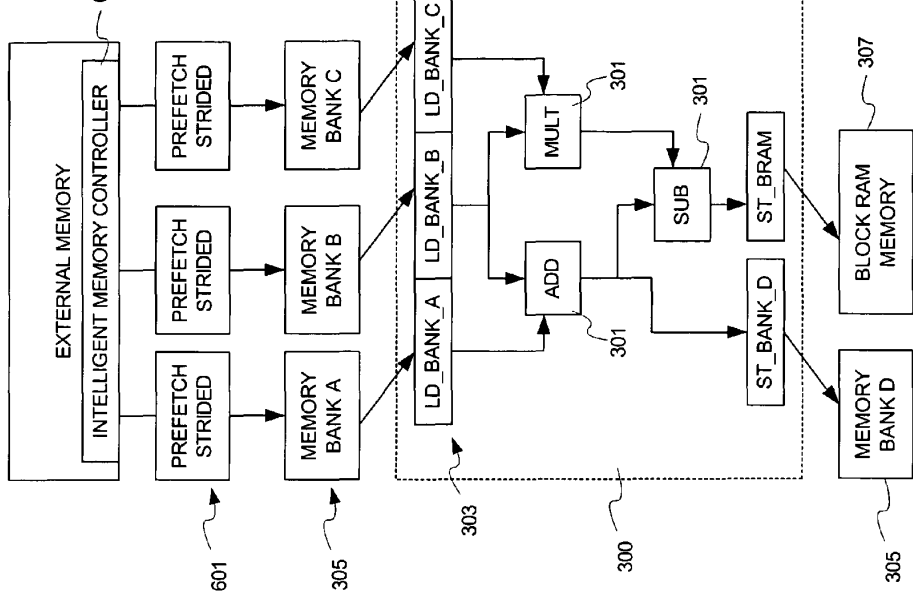


FIG. 6

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