

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
2 August 2007 (02.08.2007)

PCT

(10) International Publication Number
WO 2007/087507 A3

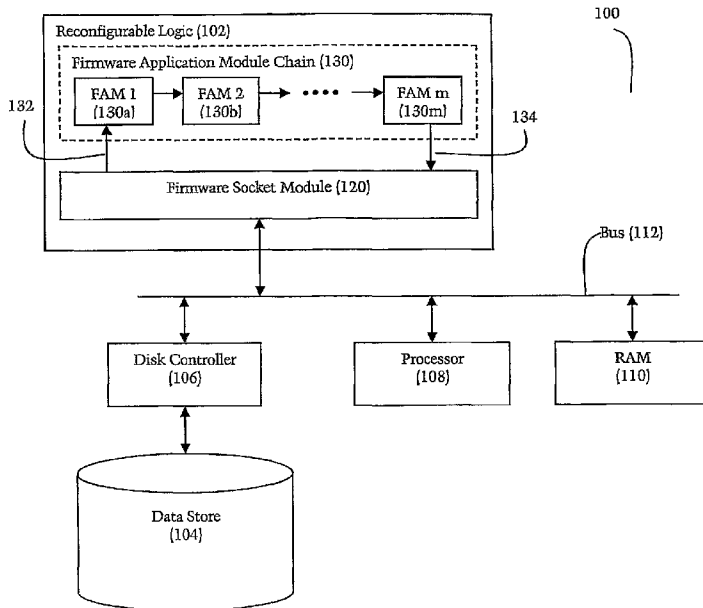
- (51) International Patent Classification:
G06F 15/78 (2006.01) G06F 9/38 (2006.01)
G06F 15/80 (2006.01)
- (21) International Application Number:
PCT/US2007/060835
- (22) International Filing Date: 22 January 2007 (22.01.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
11/339,892 26 January 2006 (26.01.2006) US
- (71) Applicants (for all designated States except US): **EXEGY INCORPORATED** [US/US]; Suite 300, 3668 South Geyer Road, St. Louis, MO 63127 (US). **WASHINGTON UNIVERSITY** [US/US]; One Brookings Drive, St. Louis, MO 63130 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **CHAMBERLAIN, Roger D.** [US/US]; 64 Notre Dame Drive, St. Louis, MO 63141 (US). **SHANDS, E.F. Berkley** [US/US]; 603 Meadowridge Lane, Kirkwood, MO 63122 (US). **BRODIE,**

Benjamin C. [US/US]; 726 Leland Avenue, 1W, University City, MO 63130 (US). **HENRICHS, Michael** [US/US]; 5708 Southwest Avenue, St. Louis, MO 63139 (US). **WHITE, Jason R.** [US/US]; 902 Dogwood Creek Drive, Apt. 1, Manchester, MO 63021 (US).

- (74) Agents: **VOLK, JR., Benjamin L.** et al.; Thompson Coburn, LLP, One US Bank Plaza, St. Louis, MO 63101 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,

[Continued on next page]

(54) Title: FIRMWARE SOCKET MODULE FOR FPGA-BASED PIPELINE PROCESSING



(57) Abstract: A firmware socket module is deployed on a reconfigurable logic device, wherein the firmware socket module has a communication path between itself and an entry point into a data processing pipeline, wherein the firmware socket module is configured to provide both commands and target data to the entry point in the data processing pipeline via the same communication path, wherein each command defines a data processing operation that is to be performed by the data processing pipeline, and wherein the target data corresponds to the data upon which the data processing pipeline performs its commanded data processing operation. Preferably, the firmware socket module is configured to provide the commands and target data in a predetermined order that is maintained throughout the data processing pipeline. Also, the firmware socket module may be configured to (1) access an external input descriptor pool buffer that

defines the order in which commands and target data are to be provided to the data processing pipeline, and (2) transfer the commands and target data from an external memory to the data processing pipeline in accordance with the identified defined order. Results of the processing by the data processing pipeline are also returned to external memory by the firmware socket module, whereupon those results can be subsequently used by software executing on a computer system.

WO 2007/087507 A3



ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
13 September 2007

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/060835

A. CLASSIFICATION OF SUBJECT MATTER INV. G06F15/78 G06F15/80 G06F9/38		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) G06F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2004/042560 A (LOCKHEED CORP [US]; MATHUR CHANDAN [US]; HELLENBACH SCOTT [US]; RAPP J) 21 May 2004 (2004-05-21) paragraph [0023]; figure 3 paragraph [0046] paragraph [0049] paragraphs [0059] - [0062] paragraph [0064] paragraph [0094]	1-3, 16, 19, 20, 25, 42 4-15, 17, 18, 21-24, 26-41, 43-49
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex. </div>		
* Special categories of cited documents :		
A document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family	
Date of the actual completion of the international search <p style="text-align: center; font-weight: bold;">9 July 2007</p>	Date of mailing of the international search report <p style="text-align: center; font-weight: bold;">13/07/2007</p>	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center; font-weight: bold;">Kamps, Stefan</p>	

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/060835

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2004/042561 A (LOCKHEED CORP [US]; SCHULZ KENNETH R [US]; RAPP JOHN W [US]; JACKSON L) 21 May 2004 (2004-05-21) paragraph [0052] paragraphs [0074], [0075]	1-3, 16, 19, 20, 25, 42 4-15, 17, 18, 21-24, 26-41, 43-49
X Y	WO 2004/042574 A (LOCKHEED CORP [US]; MATHUR CHANDAN [US]; HELLENBACH SCOTT [US]; RAPP J) 21 May 2004 (2004-05-21) paragraphs [0074] - [0077]	1-3, 16, 19, 20, 25, 42 4-15, 17, 18, 21-24, 26-41, 43-49
Y	WO 2004/042562 A (LOCKHEED CORP [US]; RAPP JOHN W [US]; JACKSON LARRY [US]; JONES MARK []) 21 May 2004 (2004-05-21) paragraphs [0079] - [0084]	12-14, 32, 33, 36, 45, 47
Y	US 5 421 028 A (SWANSON ROGER W [US]) 30 May 1995 (1995-05-30) column 3, line 57 - column 4, line 14 column 4, lines 40-58 column 6, lines 2-8 column 6, line 48 - column 7, line 7; figure 2	4-15, 17, 18, 21-24, 26-41, 43-49
Y	US 5 347 634 A (HERRELL RUSS W [US] ET AL) 13 September 1994 (1994-09-13) abstract	12-14, 32, 33, 36, 45, 47

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2007/060835

Patent document cited in search report	Publication date	Patent family member(s)	Publication date			
WO 2004042560	A	21-05-2004	AU 2003287317 A1	07-06-2004		
			AU 2003287318 A1	07-06-2004		
			AU 2003287319 A1	07-06-2004		
			AU 2003287320 A1	07-06-2004		
			AU 2003287321 A1	07-06-2004		
			CA 2503611 A1	21-05-2004		
			CA 2503613 A1	21-05-2004		
			CA 2503617 A1	21-05-2004		
			CA 2503620 A1	21-05-2004		
			CA 2503622 A1	21-05-2004		
			EP 1573514 A2	14-09-2005		
			EP 1576471 A2	21-09-2005		
			EP 1570344 A2	07-09-2005		
			EP 1573515 A2	14-09-2005		
			EP 1559005 A2	03-08-2005		
			JP 2006515941 T	08-06-2006		
			JP 2006518056 T	03-08-2006		
			JP 2006518057 T	03-08-2006		
			JP 2006518058 T	03-08-2006		
			JP 2006518495 T	10-08-2006		
			KR 20050084628 A	26-08-2005		
			KR 20050086423 A	30-08-2005		
			KR 20050088995 A	07-09-2005		
			KR 20050086424 A	30-08-2005		
			KR 20050084629 A	26-08-2005		
			WO 2004042561 A2	21-05-2004		
			WO 2004042569 A2	21-05-2004		
			WO 2004042574 A2	21-05-2004		
			WO 2004042561	A	21-05-2004	AU 2003287317 A1
AU 2003287318 A1	07-06-2004					
AU 2003287319 A1	07-06-2004					
AU 2003287320 A1	07-06-2004					
AU 2003287321 A1	07-06-2004					
CA 2503611 A1	21-05-2004					
CA 2503613 A1	21-05-2004					
CA 2503617 A1	21-05-2004					
CA 2503620 A1	21-05-2004					
CA 2503622 A1	21-05-2004					
EP 1573514 A2	14-09-2005					
EP 1576471 A2	21-09-2005					
EP 1570344 A2	07-09-2005					
EP 1573515 A2	14-09-2005					
EP 1559005 A2	03-08-2005					
JP 2006515941 T	08-06-2006					
JP 2006518056 T	03-08-2006					
JP 2006518057 T	03-08-2006					
JP 2006518058 T	03-08-2006					
JP 2006518495 T	10-08-2006					
KR 20050084628 A	26-08-2005					
KR 20050086423 A	30-08-2005					
KR 20050088995 A	07-09-2005					
KR 20050086424 A	30-08-2005					
KR 20050084629 A	26-08-2005					
WO 2004042569 A2	21-05-2004					
WO 2004042560 A2	21-05-2004					
WO 2004042574 A2	21-05-2004					

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/060835

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
WO 2004042574	A	21-05-2004	AU 2003287317 A1	07-06-2004
			AU 2003287318 A1	07-06-2004
			AU 2003287319 A1	07-06-2004
			AU 2003287320 A1	07-06-2004
			AU 2003287321 A1	07-06-2004
			CA 2503611 A1	21-05-2004
			CA 2503613 A1	21-05-2004
			CA 2503617 A1	21-05-2004
			CA 2503620 A1	21-05-2004
			CA 2503622 A1	21-05-2004
			EP 1573514 A2	14-09-2005
			EP 1576471 A2	21-09-2005
			EP 1570344 A2	07-09-2005
			EP 1573515 A2	14-09-2005
			EP 1559005 A2	03-08-2005
			JP 2006515941 T	08-06-2006
			JP 2006518056 T	03-08-2006
			JP 2006518057 T	03-08-2006
			JP 2006518058 T	03-08-2006
			JP 2006518495 T	10-08-2006
			KR 20050084628 A	26-08-2005
			KR 20050086423 A	30-08-2005
KR 20050088995 A	07-09-2005			
KR 20050086424 A	30-08-2005			
KR 20050084629 A	26-08-2005			
WO 2004042561 A2	21-05-2004			
WO 2004042569 A2	21-05-2004			
WO 2004042560 A2	21-05-2004			
<hr/>				
WO 2004042562	A	21-05-2004	NONE	
<hr/>				
US 5421028	A	30-05-1995	NONE	
<hr/>				
US 5347634	A	13-09-1994	JP 3272370 B2	08-04-2002
			JP 5094406 A	16-04-1993
<hr/>				