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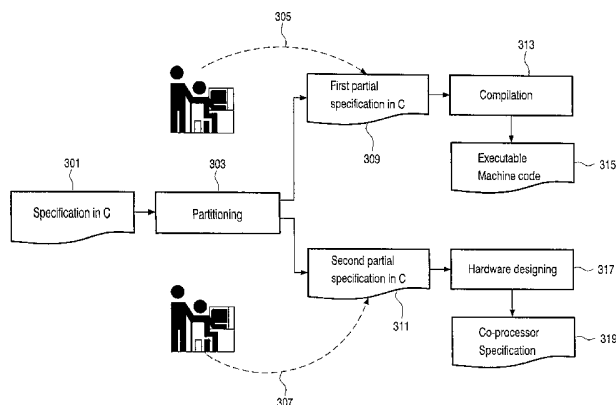
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(54) Title: SOURCE-TO-SOURCE PARTITIONING COMPILE



(57) Abstract: Target systems combining a number of different processors, for example a general-purpose processor (GP) and at least one co-processor (COP), or alternatively two or more co-processors (COPA, COPB, COPC), allow combining flexibility and speed for execution of a set of functions. The design of such target systems requires partitioning of a specification in a part to be implemented by the general-purpose processor and a part to be implemented by a co-processor, or into several parts to be implemented by different co-processors. The present invention describes a method for partitioning a specification in a source code. In a first step, the specification 301 is converted into a plurality of abstract syntax trees 101. In a second step, the plurality of abstract syntax trees 101 is partitioned into at least a first set 201 and a second set 203. The first set of abstract syntax trees 201 is to be implemented by a first processor (GP, COPA) and the second set of abstract syntax trees 203 is to be implemented by a second processor (COP, COPB). The first 201 and second set 203 of abstract syntax trees can both be translated to a specification in the original source code language 309 and 311, respectively, allowing the user to add manual changes 305 and 307 to the specifications 309 and 311. Furthermore, specific compiler tools as well as specific design tools can be used to convert the specifications 309 and 311 into corresponding executable machine code 315 and a specification of the co-processor 319, for example.



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A. CLASSIFICATION OF SUBJECT MATTER

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B. FIELDS SEARCHED

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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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/38087 A (AUBURY MATTHEW PHILIP ; DASH TECH LTD (GB); SAUL JONATHAN MARTIN (GB)) 29 June 2000 (2000-06-29) cited in the application the whole document	1-19
A	STOY E ET AL: "INTER-DOMAIN MOVEMENT OF FUNCTIONALITY AS A REPARTITIONING STRATEGY FOR HARDWARE/SOFTWARE CO-DESIGN" JOURNAL OF SYSTEMS ARCHITECTURE, ELSEVIER SCIENCE PUBLISHERS BV., AMSTERDAM, NL, vol. 43, no. 1/5, 1 March 1997 (1997-03-01), pages 87-98, XP000679758 ISSN: 1383-7621 the whole document	1-19



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Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 065 611 A (IMEC INTER UNI MICRO ELECTR) 3 January 2001 (2001-01-03) the whole document	1-19
X	SAUL J M ED - SPRAGUE R H JR: "Hardware/software codesign for FPGA-based systems" SYSTEMS SCIENCES, 1999. HICSS-32. PROCEEDINGS OF THE 32ND ANNUAL HAWAII INTERNATIONAL CONFERENCE ON MAUI, HI, USA 5-8 JAN. 1999, LOS ALAMITOS, CA, USA, IEEE COMPUT. SOC, US, 5 January 1999 (1999-01-05), page 10pp, XP010338831 ISBN: 0-7695-0001-3	1
A	the whole document	2-19
A	WO 94/10627 A (TAYLOR BRAD ; DOWLING ROBERT (US); GIGA OPERATIONS CORP (US)) 11 May 1994 (1994-05-11) page 8 page 35 figures 17-21	1-19
A	EDWARDS M D ET AL: "SOFTWARE ACCELERATION USING PROGRAMMABLE HARDWARE DEVICES" IEE PROCEEDINGS: COMPUTERS AND DIGITAL TECHNIQUES, IEE, GB, vol. 143, no. 1, 1996, pages 55-63, XP000554820 ISSN: 1350-2387 the whole document	1-19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

IB 03/02908

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0038087	A	29-06-2000	AU 1875200 A	12-07-2000
			GB 2362005 A ,B	07-11-2001
			WO 0038087 A1	29-06-2000
EP 1065611	A	03-01-2001	US 6212566 B1	03-04-2001
			EP 1065611 A2	03-01-2001
			AT 257611 T	15-01-2004
			DE 69631278 D1	12-02-2004
			EP 0772140 A1	07-05-1997
			EP 0767544 A2	09-04-1997
			US 6307877 B1	23-10-2001
			US 2003118081 A1	26-06-2003
			US 5870588 A	09-02-1999
			US 2002067757 A1	06-06-2002
WO 9410627	A	11-05-1994	US 5535342 A	09-07-1996
			AU 5458194 A	24-05-1994
			CA 2148813 A1	11-05-1994
			EP 0746812 A1	11-12-1996
			JP 8504285 T	07-05-1996
			WO 9410627 A1	11-05-1994
			AU 5593594 A	24-05-1994
			CA 2148814 A1	11-05-1994
			EP 0667010 A1	16-08-1995
			JP 8504514 T	14-05-1996
			WO 9410624 A1	11-05-1994
			US 5497498 A	05-03-1996
			US 5603043 A	11-02-1997
			US 5857109 A	05-01-1999