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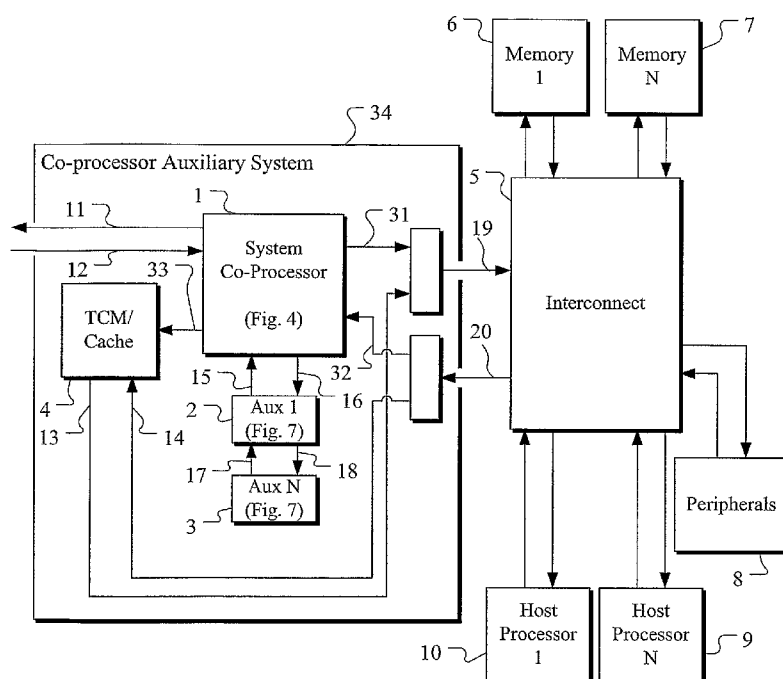
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Pasi** [FI/FI]; Saarenmaantie 111, A1, FI-36200 Kangasala(84) Designated States (unless otherwise indicated, for every
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[Continued on next page]

(54) Title: CO-PROCESSOR FOR STREAM DATA PROCESSING

**Figure 1**

(57) Abstract: An architecture is shown where a conventional direct memory access structure is replaced with a latency tolerant programmable direct memory access engine, or co-processor, that can handle multiple demanding data streaming operations in parallel. The co-processor concept includes a latency tolerant programmable core with any number of tightly coupled auxiliary units. The co-processor operates in parallel with any number of host processors, thereby reducing the host processors' load as the co-processor is configured to autonomously execute assigned tasks.



MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR),
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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

INV. 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, COMPENDEX, INSPEC, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004/225885 A1 (GROHOSKI GREGORY F [US] ET AL) 11 November 2004 (2004-11-11) paragraphs [0015], [0019], [0020], [0056], [0057], [0066], [0102] - [0104], [0124]; claims 1,11,12,15-22; figures 2,10	1-19
Y	WO 99/39475 A (TANDEM COMPUTERS INC [US]) 5 August 1999 (1999-08-05) page 4, lines 17-26 page 6, line 16 - page 15, line 9 page 19, lines 32-34; claim 21; figures 1-3 ----- -/--	1-4,6, 8-16,18, 19

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* 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
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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

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G document member of the same patent family

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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	US 2002/004904 A1 (BLAKER DAVID M [US] ET AL) 10 January 2002 (2002-01-10) paragraphs [0033], [0034], [0039] - [0047], [0049], [0050], [0057], [0058], [0063], [0067]; figure 1 -----	1,8,9, 11-13, 18,19
Y	EP 1 422 618 A (ST MICROELECTRONICS INC [US]) 26 May 2004 (2004-05-26) paragraphs [0036] - [0041], [0060] - [0062] -----	5,17
Y	GB 2 366 426 A (IBM [US]) 6 March 2002 (2002-03-06) page 1, lines 11-13 page 1, line 20 - page 2, line 22 page 3, lines 32-43 page 5, line 35 - page 8, line 23 page 9, lines 9-11 page 12, lines 26-42; claims 1,5,9,10,14,15; figures 1,5,6 -----	5,17
Y	WU L ET AL: "CryptoManiac: a fast flexible architecture for secure communication" 30 June 2001 (2001-06-30), PROCEEDINGS OF THE 28TH. INTERNATIONAL SYMPOSIUM ON COMPUTER ARCHITECTURE. ISCA 2001. GOTEORG, SWEDEN, JUNE 30 - JULY 4, 2001; [INTERNATIONAL SYMPOSIUM ON COMPUTER ARCHITECTURE.(ISCA)], LOS ALAMITOS, CA, IEEE COMP. SOC, US, PAGE(S) 104 - 113 , XP010553867 ISBN: 978-0-7695-1162-7 page 107, column 1, lines 8-13 -----	7
A	WO 01/76129 A (MOTOROLA INC [US] GEN DYNAMICS DECISION SYSTEMS [US]) 11 October 2001 (2001-10-11) page 2, line 30 - page 6, line 21 -----	1-19
A	US 2004/105541 A1 (ELBE ASTRID [DE] ET AL) 3 June 2004 (2004-06-03) paragraphs [0037], [0042] - [0045], [0055], [0057]; figures 1,2 -----	1-19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2009/000064

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1- 19

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-19

Electronic device (and corresponding system) comprising a co-processor receiving a first message signal from a host, said co-processor connected to one or more auxiliary units which execute in whole or in part the data processing in response to a second message signal from said co-processor

2. claims: 20-25

Electronic device (and corresponding method) comprising a co-processor receiving a message signal relating to task from a host processor, and comprising means for downloading the code to a memory block or running code available in the memory block or in a cache by the coprocessor which executes the task

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004225885 A1	11-11-2004	DE 112004000015 T5 GB 2416224 A TW 238945 B WO 2004099971 A2	20-04-2006 18-01-2006 01-09-2005 18-11-2004
WO 9939475 A	05-08-1999	TW 413988 B US 6378072 B1 US 2002073316 A1	01-12-2000 23-04-2002 13-06-2002
US 2002004904 A1	10-01-2002	NONE	
EP 1422618 A	26-05-2004	US 2004103263 A1	27-05-2004
GB 2366426 A	06-03-2002	US 2005033938 A1	10-02-2005
WO 0176129 A	11-10-2001	AU 5297201 A CA 2375749 A1 GB 2367404 A PL 354956 A1	15-10-2001 11-10-2001 03-04-2002 22-03-2004
US 2004105541 A1	03-06-2004	AU 3166802 A CN 1481524 A DE 10061997 A1 WO 0248845 A2 EP 1342148 A2 US 2008140739 A1	24-06-2002 10-03-2004 18-07-2002 20-06-2002 10-09-2003 12-06-2008