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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

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Declarations under Rule 4.17:
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:
— with international search report (Art. 21(3))

[Continued on next page]

(54) Title: MULTI-CORE MICROPROCESSOR RELIABILITY OPTIMIZATION

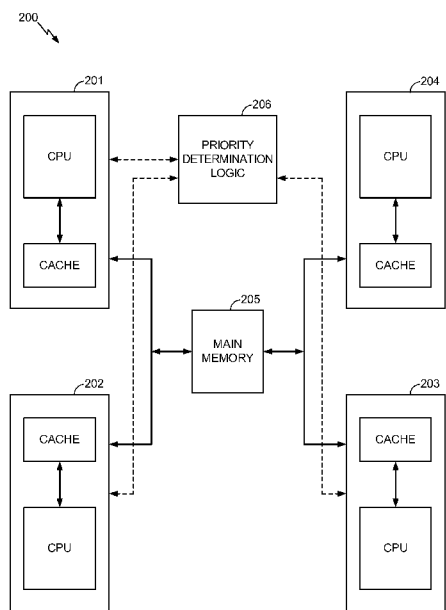
FIG. 2

(57) Abstract: Systems and methods for improving effective aging of a multi-core processor. Aging characteristics of the two or more cores of the multi-core processor are determined. Priority determination logic is configured to assign priorities for powering on the cores based on the aging characteristics. Optionally, an operating environment is detected and assigning priorities to the cores is based on a relative power consumption of each of the cores and the operating environment, in order to improve battery life.

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) **Date of publication of the international search report:**
19 December 2013

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06F1/32   G06F15/80   G06F9/50
ADD.

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/240979 A1 (CAMPINI EDOARDO [US] ET AL) 24 September 2009 (2009-09-24)	1,2, 9-15,24, 25,32-39
Y	page 1, paragraph 0006 page 1, paragraphs 0009, 0010, 0011 page 2, paragraph 0015 page 2, paragraph 0017	3-8, 26-31

X	US 2011/173432 A1 (CHER CHEN-YONG [US] ET AL) 14 July 2011 (2011-07-14)	1,2, 9-15,24, 25,32-39
Y	abstract page 4, paragraph 0043 page 5, paragraph 0051	3-8, 26-31

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[X] Further documents are listed in the continuation of Box C.   [X] See patent family annex.

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*  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 application or patent 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
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Date of the actual completion of the international search	Date of mailing of the international search report
18 October 2013	29/10/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Gafita, Cristinel

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

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:

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see additional sheet
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1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable 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.:

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.

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2005)

INTERNATIONAL SEARCH REPORT

C(Continuation).   DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	LIN HUANG ET AL: "Characterizing the lifetime reliability of manycore processors with core-level redundancy", 7 November 2010 (2010-11-07), COMPUTER-AIDED DESIGN (ICCAD), 2010 IEEE/ACM INTERNATIONAL CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, PAGE(S) 680 - 685, XP031815367, ISBN: 978-1-4244-8193-4	1,2
A	abstract page 1, right-hand column, lines 53 - 55 -----	3-39
X	US 2009/150893 A1 (JOHNSON DARRIN PAUL [US] ET AL) 11 June 2009 (2009-06-11)	16-21
Y	page 2, paragraphs 22, 25 page 4, paragraph 48 page 5, paragraphs 54, 55 page 9, paragraphs 86, 89 page 10, paragraphs 95, 97, 99 -----	22,23
Y	US 2010/153954 A1 (MORROW MICHAEL WILLIAM [US] ET AL) 17 June 2010 (2010-06-17) page 3, paragraphs 36, 37 page 5, paragraph 49 -----	22,23

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 2009240979	A1	24-09-2009	NONE		
US 2011173432	A1	14-07-2011	NONE		
US 2009150893	A1	11-06-2009	NONE		
US 2010153954	A1	17-06-2010	CN	102246117 A	16-11-2011
			EP	2374048 A2	12-10-2011
			JP	5283759 B2	04-09-2013
			JP	2012511788 A	24-05-2012
			KR	20110102449 A	16-09-2011
			TW	201035745 A	01-10-2010
			US	2010153954 A1	17-06-2010
			WO	2010068855 A2	17-06-2010

FURTHER INFORMATION CONTINUED FROM   PCT/ISA/ 210

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

1. claims: 1-15, 24-39

   These claims are concerned with methods for determining
   cores to be powered on based on ageing characteristics.
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2. claims: 16-23

   These claims regard a method for managing a multi-core
   processor by determining cores to be powered on based on
   power consumption.