

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
20 May 2010 (20.05.2010)

(10) International Publication Number
WO 2010/056571 A3

(51) International Patent Classification:
G06F 9/00 (2006.01) G06F 13/10 (2006.01)
G06F 12/08 (2006.01)

98052-6399 (US). KIRSHENBAUM, Alexander; c/o Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399 (US).

(21) International Application Number:
PCT/US2009/063127

(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, 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, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date:
3 November 2009 (03.11.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/271,400 14 November 2008 (14.11.2008) US

(71) Applicant (for all designated States except US): MICROSOFT CORPORATION [US/US]; One Microsoft Way, Redmond, Washington 98052-6399 (US).

(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, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors: IYIGUN, Mehmet; c/o Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399 (US). BAK, Yevgeniy; c/o Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399 (US). FORTIN, Michael; c/o Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399 (US). FIELDS, David; c/o Microsoft Corporation, One Microsoft Way, Redmond, Washington 98052-6399 (US). ERGAN, Cenk; c/o Microsoft Corporation, One Microsoft Way, Redmond, Washington

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: MANAGING CACHE DATA AND METADATA

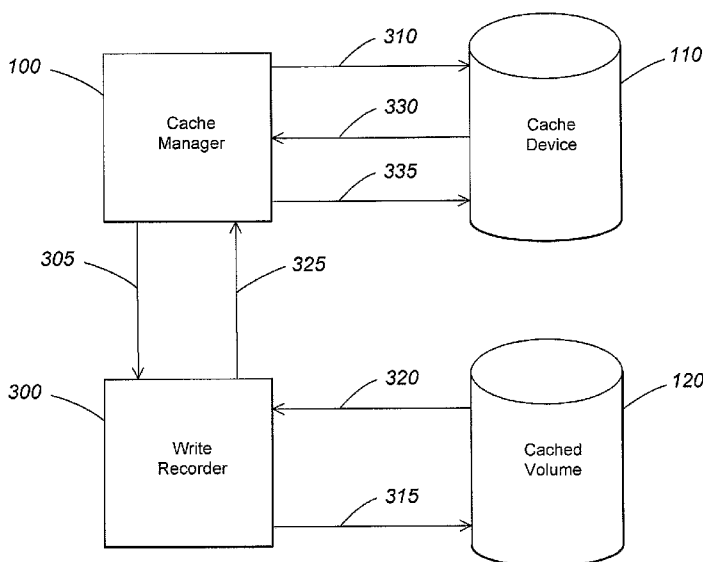


FIG. 3

(57) Abstract: Techniques are provided for managing cache metadata that maps addresses on a storage medium (e.g., disk) to corresponding addresses on a cache device. Cache metadata may be stored in a hierarchical data structure. Only a subset of the levels of the hierarchy may be loaded to memory, thus reducing the cache metadata's memory "footprint" and expediting its restoration during startup. Startup may be further expedited by using cache metadata to perform operations associated with reboot. As requests to read data from storage are processed using cache metadata to identify the address(es) at which the data are stored in cache, the identified address(es) may be stored in memory. When the computer is later shut down, instead of having to transfer the entirety of cache metadata from memory to storage, only the subset of the hierarchy levels and/or identified addresses may be transferred (e.g., to the cache device), expediting shutdown.

WO 2010/056571 A3



— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))* — *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))*

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
29 July 2010

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/063127**A. CLASSIFICATION OF SUBJECT MATTER***G06F 9/00(2006.01)i, G06F 12/08(2006.01)i, G06F 13/10(2006.01)i*

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)

IPC 8: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models applications for Utility Models since 1975, IPC as above

Japanese Utility Models and application for Utility Models since 1975, IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS, IEEEExpl, Google;MANAGING, CACHE DATA, METADATA;

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006-0080553 A1 (WILLIAM E. HALL) 13 Apr. 2006 See the abstract, claims 1-26 and figures 1-8B.	1-15
A	US 2006-0074953 A1 (RICHARD D. DETTINGER et al.) 6 Apr. 2006 See the abstract, claims 1-24 and figures 1-8B.	1-15
A	US 2006-0136472 A1 (VENKATESWARARAO JUJJURI et al.) 22 Jun. 2006 See the abstract, claims 1-24 and figures 1-6.	1-15

 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 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 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

29 MAY 2010 (29.05.2010)

Date of mailing of the international search report

31 MAY 2010 (31.05.2010)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

BOK, Jin Yo

Telephone No. 82-42-481-5113



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/063127

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-080553 A1	13.04.2006	None	
US 2006-0074953 A1	06.04.2006	US 2009-144251 A1 US 2008-0033976 A1 US 07505958 B2 US 07574423 B2 US 2004-0186840 A1	04.06.2009 07.02.2008 17.03.2009 11.08.2009 23.09.2004
US 2006-0136472 A1	22.06.2006	CN 1794207 A CN 1794207 C0 US 07480654 B2	28.06.2006 28.06.2006 20.01.2009