

(51) International Patent Classification:
G06F 15/16 (2006.01) **G06F 9/38** (2006.01)98103 (US). **LEMAR, Eric, Michael** [US/US]; 4213
Stone Way N, Apt. 403, Seattle, WA 98103 (US).(21) International Application Number:
PCT/US2011/024551(74) Agents: **BRANCH, John, W.** et al.; Frommer Lawrence
& Haug LLP, 745 Fifth Avenue, New York, NY 10151
(US).(22) International Filing Date:
11 February 2011 (11.02.2011)(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, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

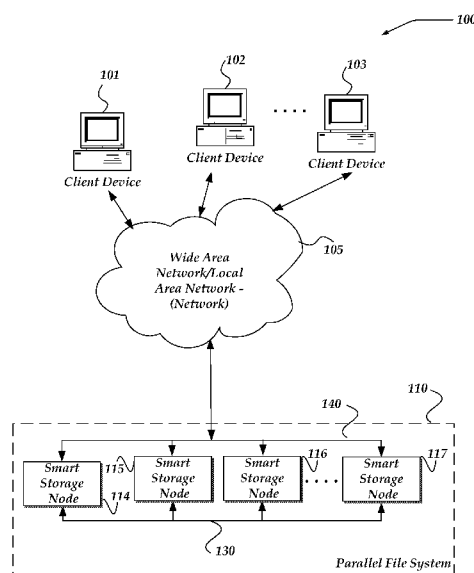
(30) Priority Data:
12/704,285 11 February 2010 (11.02.2010) US(71) Applicant (for all designated States except US): **EMC
CORPORATION** [—/US]; 176 Street South, Hopkinton,
MA 01748 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HUGHES, Jeffrey,
Douglas** [US/US]; 812 5th Avenue N, Apt. 309, Seattle,
WA 98109 (US). **SMITH, Sean, MacQueen** [US/US];
227 NW 50th St., Seattle, WA 98107 (US). **PETERSEN,
Kalen, Albert** [US/US]; 208 N 51st St., Seattle, WA(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,

[Continued on next page]

(54) Title: PARALLEL FILE SYSTEM PROCESSING



(57) Abstract: A treewalk for splitting a file directory is disclosed for parallel execution of work items over a filesystem. The given work item is assigned to a worker. Thereafter, a request is sent to split the file directory to share a portion of the file directory with another worker. The worker examines the file directory for a next splittable directory entry key after a current in-progress location within a key space for the file directory. If no key is detected, the file directory is identified as unsplittable. If an entry is detected, the key space is progressively searched for a next entry between a next available directory entry key and an upper boundary. The worker identifies the file directory as splittable if the next available entry is found, providing a range of entries within the file directory for which parallel execution of the work item.

FIG. 1



LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, (88) Date of publication of the international search report:
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, 22 December 2011
GW, ML, MR, NE, SN, TD, TG).

Published:

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/024551**A. CLASSIFICATION OF SUBJECT MATTER****G06F 15/16(2006.01)i, G06F 9/38(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)

G06F 15/16; G06F 12/16; G06F 17/30; G06F 12/00; G06F 13/28; G06F 11/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: file directory, parallel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004-0267838 A1 (CURRAN, R. J. et al.) 30 December 2004 See abstract; paragraphs [0010-0018]; and figure 1.	1-29
A	US 2006-0064536 A1 (TINKER, J. L. et al.) 23 March 2006 See abstract; paragraphs [0054-0055]; claims 1, 2, 6; and figure 1.	1-29
A	US 2006-0117018 A1 (CHRISTIANSEN, N. R. et al.) 01 June 2006 See abstract; and paragraphs [0003, 0080-0083].	1-29
A	US 6021508 A (SCHMUCK, F. B. et al.) 01 February 2000 See abstract; claim 1; and figure 1.	1-29

☐ 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

26 SEPTEMBER 2011 (26.09.2011)

Date of mailing of the international search report

27 SEPTEMBER 2011 (27.09.2011)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsu-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, Sang Hun

Telephone No. 82-42-481-5914



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/024551

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004-0267838 A1	30.12.2004	JP 2005-018758 A	20.01.2005
		JP 4157858 B2	01.10.2008
		KR 10-0600933 B1	13.07.2006
		KR 10-2005-0001304 A	06.01.2005
		US 7092976 B2	15.08.2006
US 2006-0064536 A1	23.03.2006	CN 101027668 A	29.08.2007
		CN 101027668 C0	29.08.2007
		EP 1782287 A2	09.05.2007
		JP 2008-507771 A	13.03.2008
		JP 4663718 B2	14.01.2011
		KR 10-0899462 B1	27.05.2009
		KR 10-2007-0083489 A	24.08.2007
		US 7640274 B2	29.12.2009
		WO 2006-012418 A2	02.02.2006
		WO 2006-012418 A3	29.06.2006
US 2006-0117018 A1	01.06.2006	AU 2005-220174 A1	15.06.2006
		BR PI0505047 A	07.08.2007
		CA 2524421 A1	30.05.2006
		CN 1783081 A	07.06.2006
		CN 1783081 C0	07.06.2006
		EP 1662408 A1	31.05.2006
		JP 2006-155606 A	15.06.2006
		KR 10-2006-0060549 A	05.06.2006
		MX PA05011697 A	14.11.2007
		RU 2005133391 A	10.05.2007
		ZA 200508765 A	25.07.2007
US 6021508 A	01.02.2000	CA 2242833 C	07.09.2004
		EP 0890915 A2	13.01.1999
		EP 0890915 A3	23.02.2005
		EP 0890915 B1	17.06.2009
		EP 0890916 A2	13.01.1999
		EP 0890916 A3	23.02.2005
		EP 0890916 B1	17.06.2009
		EP 0892347 A2	20.01.1999
		EP 0892347 A3	03.12.2003
		EP 0892347 B1	05.09.2007
		KR 10-0292643 B1	15.06.2001
		KR 10-1999-0013792 A	25.02.1999
		TW 412692 A	21.11.2000
		US 5893086 A	06.04.1999
		US 5940838 A	17.08.1999
		US 5946686 A	31.08.1999
		US 5950199 A	07.09.1999
		US 5956734 A	21.09.1999
		US 5960446 A	28.09.1999
		US 5963963 A	05.10.1999

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/024551

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 5974424 A	26.10.1999
		US 5999976 A	07.12.1999
		US 6021508 A	01.02.2000
		US 6032216 A	29.02.2000
		US 6820122 B1	16.11.2004