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- (71) **Applicant (for all designated States except US):** **MICROSOFT CORPORATION** [US/US]; One Microsoft Way, Redmond, Washington 98052-6399 (US).
- (72) **Inventors:** **STARKS, John A.**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US). **GREEN, Dustin L.**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US).

(US). **HARRIS, Todd William**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US). **JOHN, Mathew**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US). **RAJARAM, Senthil**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US). **MEHRA, Karan**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US). **CHRISTIANSEN, Neal R.**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US). **DAI, Chung Lang**; c/o Microsoft Corporation, LCA - International Patents, One Microsoft Way, Redmond, Washington 98052-6399 (US).

- (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,

[Continued on next page]

(54) **Title:** VIRTUAL DISK STORAGE TECHNIQUES

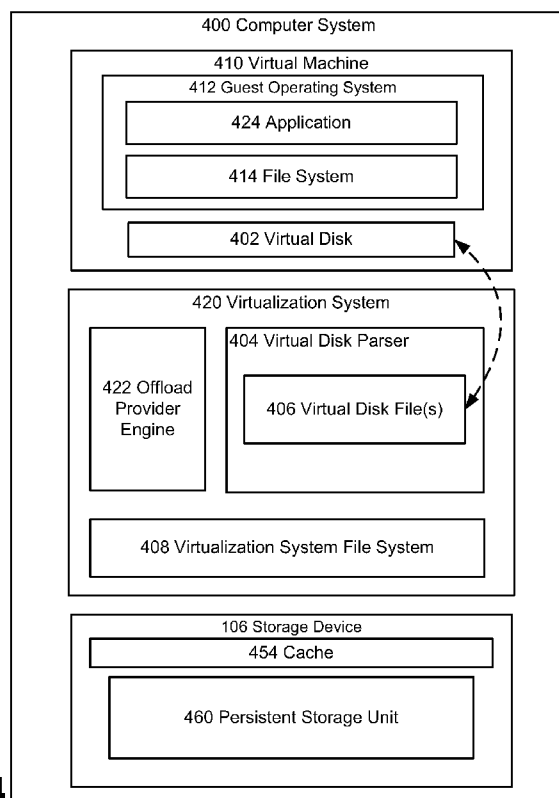


FIG. 4

(57) **Abstract:** This document describes techniques for storing virtual disk payload data. In an exemplary configuration, each virtual disk extent can be associated with state information that indicates whether the virtual disk extent is described by a virtual disk file. Under certain conditions the space used to describe a virtual disk extent can be reclaimed and state information can be used to determine how read and/or write operations directed to the virtual disk extent are handled. In addition to the foregoing, other techniques are described in the claims, figures, and detailed description of this document.



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, QA, RO, RS, RU, RW, 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.

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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:

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/027645**A. CLASSIFICATION OF SUBJECT MATTER****G06F 12/08(2006.01)i, G06F 9/06(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 12/08; G06F 15/16; G06F 12/10; G06F 12/00; G06F 9/46; G06F 9/455

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: virtual, disk, file, extent, allocate, trim, unmap, offload, state

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011-0055406 A1 (PIPER, SCOTT A. et al.) 03 March 2011 See paragraphs [0031]-[0064]; claim 1; figures 2, 3.	1-10
A	US 7886115 B2 (SANVIDO, MARCO et al.) 08 February 2011 See column 1, line 64 - column 5, line 25; figures 1-3.	1-10
A	US 2010-0241785 A1 (CHEN, XIAOXIN et al.) 23 September 2010 See paragraphs [0058]-[0068], [0095]-[0105]; figures 3-6.	1-10
A	JP 2010-033206 A (FUJITSU LTD.) 12 February 2010 See paragraphs [0045]-[0070]; claim 1; figure 2.	1-10

☐ 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

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"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

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Date of the actual completion of the international search

25 SEPTEMBER 2012 (25.09.2012)

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Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

JANG Ho Keun

Telephone No. 82-42-481-8187



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/027645

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