

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
15 July 2021 (15.07.2021)



(10) International Publication Number
WO 2021/141673 A1

(51) International Patent Classification:
G06F 9/52 (2006.01) *G06F 12/02* (2006.01)

(21) International Application Number:
PCT/US2020/060813

(22) International Filing Date:
17 November 2020 (17.11.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
16/735,418 06 January 2020 (06.01.2020) US

(71) Applicant: MICROSOFT TECHNOLOGY LICENSING, LLC [US/US]; One Microsoft Way, Redmond, Washington 98052-6399 (US).

(72) Inventors: STEPHENS, Maoni Zhang; MICROSOFT TECHNOLOGY LICENSING, LLC, One Microsoft Way, Redmond, Washington 98052-6399 (US). DUSSUD, Patrick Henri; MICROSOFT TECHNOLOGY LICENSING, LLC, One Microsoft Way, Redmond, Washington 98052-6399 (US).

(74) Agent: SWAIN, Cassandra T. et al.; MICROSOFT TECHNOLOGY LICENSING, LLC, 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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO,

(54) Title: LOCK-FREE READING OF UNITARY VALUE SETS

EXAMPLE OF A
LOCK-FREE UNITARY SET UPDATES CONVEYANCE PROCESS 800

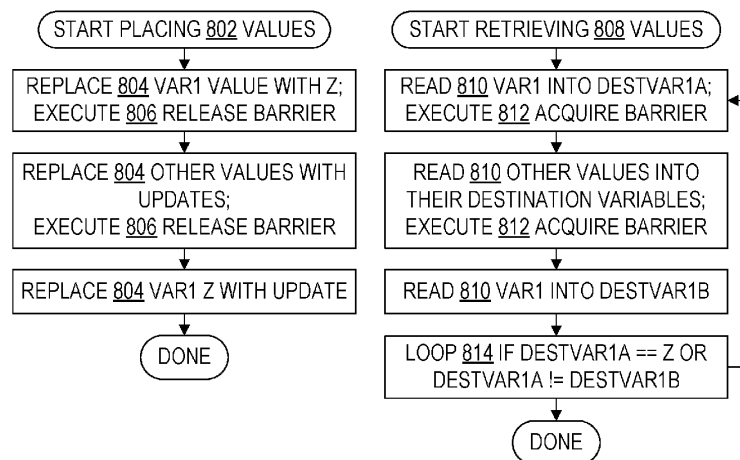


Fig. 8

(57) Abstract: Garbage collectors and other software may utilize performant lock-free multithreaded software. Unitary lock-free updates to a set of variables involves an updating value Z, release barriers and acquire barriers that enforce orderings on code execution, and atomicity resulting from variable alignment. Conveyance is accomplished with a values placing step and a values retrieving step. Values placing replaces a non-updated value in Var1 with Z, executes a release barrier, replaces the non-updated values of other variables with update values, executes another release barrier, and replaces Z with the Var1 update value. Values retrieving reads from Var1 into DestVar1A, executes an acquire barrier, reads from the other variables into respective destination variables, executes another acquire barrier, reads from Var1 into DestVar1B, and repeats if DestVar1A is Z or if DestVar1A and DestVar1B are unequal. This solution conveys the update values without locks, as a unit.

[Continued on next page]

NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW,
SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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))*