

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
04 November 2021 (04.11.2021)



(10) International Publication Number
WO 2021/219408 A1

(51) International Patent Classification:

G06N 3/10 (2006.01) G06F 9/44 (2018.01)
G06F 8/41 (2018.01) G06N 10/00 (2019.01)

(21) International Application Number:

PCT/EP2021/060018

(22) International Filing Date:

19 April 2021 (19.04.2021)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

16/860,644 28 April 2020 (28.04.2020) US

(71) Applicant: **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, New York 10504 (US).

(71) Applicant (for MG only): **IBM DEUTSCHLAND GMBH** [DE/DE]; IBM-Allee 1, 71139 Ehningen (DE).

(72) Inventors: **GAMBETTA, Jay**; c/o IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Route 134, P.O. Box 218, Yorktown Heights, New York 10598 (US). **FARO SERTAGE, Ismael**; c/o IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Route 134, P.O. Box 218, Yorktown Heights, New York 10598 (US). **MARTIN**

FERNANDEZ, Francisco; c/o IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Route 134, P.O. Box 218, Yorktown Heights, New York 10598 (US).

(74) Agent: **FERARA, Nina**; c/o IBM Deutschland GmbH, Patentwesen und Urheberrecht, IBM-Allee 1, 71139 Ehningen (DE).

(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, 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,

(54) Title: EFFICIENT QUANTUM ADAPTIVE EXECUTION METHOD FOR QUANTUM CIRCUITS

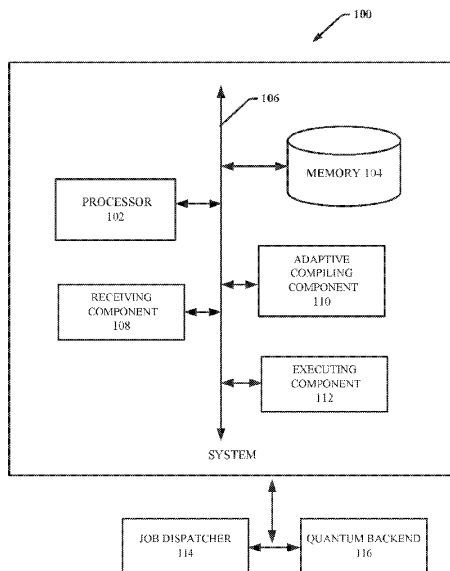


FIG. 1

(57) Abstract: Disclosed are systems and methods that can facilitate a quantum adaptive execution method based on previous quantum circuits and intermediate results. This can generate an optimized adaptive compilation methodology for a specific backend and the previous quantum circuits depends and redirect by the job dispatcher to the right quantum backend. Some of the quantum circuits can be dependent on other quantum circuits based on the intermediate results produced by previous circuits. The system can manage the optimization of circuits based on its dependencies and by the results generated by the previous quantum circuits. In this way, the system can get an optimal result for a quantum circuit and inject it to the compiler unit to generate an adaptive compilation result. The resulting post-processing unit is the one in charge to apply this logic and manage the input/output of data to push it in the compiler units and the job dispatcher.

WO 2021/219408 A1

[Continued on next page]

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

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