

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
08 June 2023 (08.06.2023)



(10) International Publication Number
WO 2023/102574 A1

(51) International Patent Classification:
G06F 21/62 (2013.01)

(21) International Application Number:
PCT/US2022/081344

(22) International Filing Date:
12 December 2022 (12.12.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/357,930 01 July 2022 (01.07.2022) US
17/897,102 26 August 2022 (26.08.2022) US

(71) Applicant: **SPACE AND TIME LABS, INC.** [US/US];
2122 S. El Camino Real, Suite E, San Clemente, CA 92672
(US).

(72) Inventors: **WHITE, Jay, Thomas**; C/o 2122 S. El Camino
Real, Suite E, San Clemente, CA 92672 (US). **DYKSTRA,**

Scott, Edward Daly; C/o 2122 S. El Camino Real, Suite E,
San Clemente, CA 92672 (US).

(74) Agent: **GALLO, Nicholas, J.**; TROUTMAN PEPPER
HAMILTON SANDERS LLP, 70 Linden Oaks, Suite 210,
Rochester, NY 14625 (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, CV, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE,
KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU,
LY, MA, MD, 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, CV,

(54) Title: METHODS FOR VERIFYING DATABASE QUERY RESULTS AND DEVICES THEREOF

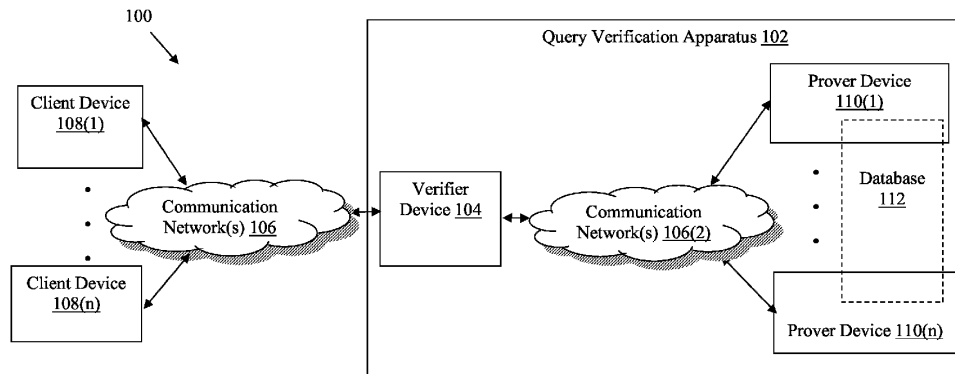


FIG. 1

(57) **Abstract:** Methods, non-transitory computer readable media, and query verification apparatuses are disclosed that receive data, store the data into a table of a database, and receive a query that is associated with the database table. A query plan and a query result are generated for the query, one or more partial proofs are generated from one or more commitments, and an overall proof is generated from the one or more partial proofs. Each of the one or more partial proofs is associated with at least one node of the query plan in some examples, which can include a directed acyclic graph. The overall proof is returned along with the query result in response to the query to facilitate verification of the query result. One or more GPUs are configured to generate the one or more commitments in some examples to thereby accelerate the verification process and improve database scalability.

[Continued on next page]

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, ME, 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).

Published:

- *with international search report (Art. 21(3))*
- *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))*
- *upon request of the applicant, before the expiration of the time limit referred to in Article 21(2)(a)*