


PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P30684PC00	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/NO2024/050031	International filing date (<i>day/month/year</i>) 12.02.2024	Priority date (<i>day/month/year</i>) 10.02.2023
International Patent Classification (IPC) or national classification and IPC INV. G06F9/50		
Applicant GREEN DATA CENTER TECHNOLOGIES AS		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>7</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> a total of _____ sheets, as follows:</p> <p style="margin-left: 20px;"><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 20px;"><input type="checkbox"/> sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).</p> <p style="margin-left: 20px;"><input type="checkbox"/> superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).</p> <p>b. <input type="checkbox"/> a separate electronic file containing a sequence listing (<i>sent to the International Bureau only</i>)</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand 06.05.2024	Date of completion of this report 27.06.2024	
Name and mailing address of the international preliminary examining authority:  European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	Authorized officer Archontopoulos, E Telephone No. +31 70 340-2673	



Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- the international application in the language in which it was filed
 - a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3(a) and 23.1(b))
 - publication of the international application (under Rule 12.4(a))
 - international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-14 as originally filed

Claims, Numbers

1-24 as originally filed

Drawings, Sheets

1/3-3/3 as originally filed

a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. The amendments have resulted in the cancellation of:
- the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
5. This report has been established:
- taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
 - without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

6. With regard to top-up searches (Rules 66.1 *ter* and 70.2(f)):
- A top-up search was carried out by this Authority on 31.05.2024 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
 - Additional relevant documents have been discovered during the top-up search.
 - No top-up search was carried out by this Authority because it would serve no useful purpose.
7. Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* *If item 4 applies, some or all of those sheets may be marked "superseded".*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-24</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>1-24</u>
	No: Claims	
Industrial applicability (IA)	Yes: Claims	<u>1-24</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Prior art

1 Reference is made to the following document:

D1: US 11 194 353 B1, 7 December 2021.

Inventive step

2 D1 discloses the following features of claim 1:

- A system for harnessing heat generated from running at least one virtual operative system instance, the system comprising:
 - *[column 4, lines 19-27] ... heat produced by a server system can be used to heat a facility. Typically, in a large facility, the heat produced is in excess of that required for the facility ... harvesting of the waste heat may, of course, be considered in the allocation decisions, including the efficiency of the harvesting and its net cost benefit.*
- At least two host computers for running the at least one virtual operative system instance, the at least two host computers being networked:
 - *[column 14, lines 20-24] ... by globally scheduling more work to a fewer number of active servers (and by keeping the non-active servers in a standby state), we push the workload level on individual servers more towards a region where energy-efficiency is very high.*
 - It is implicit that the individual servers are networked.
- A subsystem for harnessing heat generated by the at least two host computers:
 - *Ibidem, "push the workload level on individual servers more towards a region where energy-efficiency is very high".*
- ~~Wherein one or more of the at least two host computers is configured to operate as a controller of the at least two host computers;~~
- Wherein the controller is configured to carry out the steps of: for each virtual operative system instance, estimating a heat rate that will result from running the instance as a guest of a host computer:

- *[column 5, lines 31-35] The heat generation may be estimated ... by profiling the tasks to be performed, and a statistically and empirically determined amount of power which is consumed by that task.*
 - ~~Calculating an arrangement of the at least one virtual operative system instance over the at least two host computers so that a heat rate achieved by the at least two host computers is maximized;~~
 - Controlling the at least two host computers to run the at least one virtual operative system instance as defined in the calculated arrangement:
 - *[column 12, line 62-65] The computed thermal trends are used, in turn, to guide global and rack level job scheduling and VM management.*
- 3 The subject-matter of claim 1 therefore differs from D1's disclosure in the provision of this feature:
- one or more of the at least two host computers is configured to operate as a controller of the at least two host computers;
 - calculating an arrangement of the at least one virtual operative system instance over the at least two host computers so that a heat rate achieved by the at least two host computers is maximized.
- 4 In D1, see column 12, line 55-62, "[the] estimate of the energy dissipated by a server within a sampling interval is used to guide local scheduling and control the local system settings. The estimates of the server energy dissipations within a rack are also used as the inputs to a fast, optimized and calibrated thermal model that provides data on the thermal trends, taking into account the environmental conditions. The computed thermal trends are used, in turn, to guide global and rack level job scheduling and VM management".
- 5 In D1, it is the load balancing or load allocation switch that performs the estimation of the heat rate, i.e., a third computer. In claims 1 and 7, however, it is one of the computer actively participating to the shared scheduling of the virtual machines. The allocation of responsibilities, in this case, does not lead to a non-obvious effect, as this merely and derives from a design constraint, the technical implementation of which is straightforward for the skilled person.
- 6 The technical effect derives from the second distinguishing technical feature and is the maximization of the heat rate generated by the at least two host computers when being allocated the number of virtual operative system instances being run.

- 7 The objective technical problem can, therefore, be envisaged to be how to maximise the heat rate generated by the at least two host computers when being allocated the number of virtual operative system instances being run.
- 8 Faced with D1 and seeking solution to this objective technical problem, the skilled person would not be incentivised and enabled to 1) consider maximising the heat dissipation and 2) modify D1 accordingly.
- 9 Indeed, D1 aims at maximising the (number of) tasks being run whilst keeping the heat dissipation within a determined envelope dictated by the cooling system. D1's goal, in other words, is not compatible to claim 1's distinguishing technical features' effect.
- 10 Arriving at the teaching of claim 1, or its equivalents, from D1 and the objective technical problem would only be possible with hindsight.
- 11 Thus, the subject-matter of claim 1 is inventive within the meaning of Article 33(3) PCT.
- 12 Given the substantial correspondence, the subject-matter of claim 7 is inventive, too.
- 13 The subject-matter of claims 13 and 19 substantially corresponds to that of claims 1 and 7 except for the provision of the feature "a controller computer for controlling the at least two host computers" replacing the first feature identified above in the distinguishing technical features.
- 14 D1 discloses this feature, i.e., "a controller computer for controlling the at least two host computers", because it is the load balancing switch that does the estimation, i.e., the load balancing switch is the controller computer:
- *[column 5, lines 31-35] The heat generation may be estimated by the load balancing (or in this case, load allocation) switch by profiling the tasks to be performed, and a statistically and empirically determined amount of power which is consumed by that task.*
- 15 However, since, as seen above, the non-obvious technical effect derives from the second distinguishing technical feature, the subject-matter of claims 13 and 19 does, therefore, involve an inventive step.
- 16 Given their dependencies, the subject-matter of claims 2-6, 8-12, 14-18 and 20-24 involves an inventive step.

Industrial applicability

- 17 All claims are industrially applicable because they are directed to allocating virtual machines to servers.