

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**
(PCT Rule 43*bis*.1)

To:

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Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/US2018/033997

International filing date (day/month/year)
23.05.2018

Priority date (day/month/year)
29.06.2017

International Patent Classification (IPC) or both national classification and IPC
INV. G06F11/36

Applicant
MICROSOFT TECHNOLOGY LICENSING, LLC

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:



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Date of completion of this opinion

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - 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 (Rules 12.3(a) and 23.1 (b)).
2. This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. forming part of the international application as filed:
 - in the form of an Annex C/ST.25 text file.
 - on paper or in the form of an image file.
 - b. furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. furnished subsequent to the international filing date for the purposes of international search only:
 - in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4. In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-15</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	<u>1-15</u>
Industrial applicability (IA)	Yes: Claims	<u>1-15</u>
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Rule 43bis

1 Prior art

Reference is made to the following documents:

D1 US 2007/168989 A1 (EDWARDS ANDREW J [US] ET AL) 19 July 2007
(2007-07-19)

D2 US 2010/223446 A1 (KATARIYA SANJEEV [US] ET AL) 2 September
2010 (2010-09-02)

D3 LEESA HICKS ET AL: "Debugging heterogeneous applications with
Pangaea",
PARALLEL AND DISTRIBUTED TOOLS, ACM, 2 PENN PLAZA, SUITE
701 NEW YORK NY 10121-0701 USA, 1 January 1996 (1996-01-01),
pages 41-50, XP058332276,
DOI: 10.1145/238020.238036
ISBN: 978-0-89791-846-6

2 Lack of inventive step, Article 33(3) PCT

The present application does not meet the requirements of Article 33(3) PCT,
because the subject-matter of claims 1-15 does not involve an inventive step in the
sense of Rule 65(1) and (2) PCT.

2.1 Independent method claim 1

2.1.1 The document D1 is regarded as being the closest prior art to the subject-
matter of present claim 1. It discloses (the references in parentheses applying
to D1, features missing in D1 in ~~strike-through font~~):

A system that performs a distributed trace recording,

(Abstract, Figs. 29-31)

comprising:

a first computer system comprising computer-executable instructions configured to perform at least the following, when executed:

record a first trace of execution of a first entity at one or more processors the first computer system,

(Paragraph [0003], in conjunction with a first processor of the multiple ones mentioned in paragraph [0129])

including recording into the first trace a first plurality of orderable events that occur during execution of the first entity,

(Paragraphs [0154]-[0156])

the first trace recorded at fidelity that enables complete replay of the recorded execution of the first entity;

(Abstract and paragraph [0042]: it is clear that the recorded information is intended to allow a complete replay)

~~*identify sending of a message from the first entity to a second entity external to the first computer system; and*~~

~~*based on identifying the sending of the message, record first information into the first trace that at least partially orders sending of the message among the first plurality of orderable events; and*~~

a second computer system comprising computer-executable instructions configured to perform at least the following, when executed:

concurrent to the first computer system recording the first trace of execution of the first entity, record a second trace of execution of the second entity at one or more processors of the second computer system,

(Paragraph [0003], in conjunction with a second processor of the multiple ones mentioned in paragraph [0129], wherein it is clear that the multiple thread(s) executing on the different processors (paragraph [0131]) are concurrently recorded, see also paragraph [0154])

including recording into the second trace a second plurality of orderable events that occur during execution of the second entity,

(Paragraphs [0154]-[0156], it is clear that the same type of recording occurs as on the first processor)

the second trace recorded at fidelity that enables complete replay of the recorded execution of the second entity;

(Abstract and paragraph [0042]: it is clear that the recorded information is intended to allow a complete replay of the second processor to same extent as of the first processor)

~~*identify receipt of the message by the second entity; and based on identifying the receipt of the message, record second information into the second trace that at least partially orders receipt of the message among the second plurality of orderable events, and wherein the first information and the second information identify at least a partial ordering of the first plurality of orderable events versus the second plurality of orderable events.*~~

2.1.2 The difference between the invention as defined by present claim 1 and the prior art discussed under 2.1.1 is:

1. *identify sending of a message from the first entity to a second entity external to the first computer system; and based on identifying the sending of the message, record first information into the first trace that at least partially orders sending of the message among the first plurality of orderable events; and*
2. *identify receipt of the message by the second entity; and based on identifying the receipt of the message, record second information into the second trace that at least partially orders receipt of the message among the second plurality of orderable events,*
3. *and wherein the first information and the second information identify at least a partial ordering of the first plurality of orderable events versus the second plurality of orderable events.*

The effect of these distinguishing features is the that related traces from two computer systems can be synchronised relative to each other.

2.1.3 The objective technical problem to be solved by the subject-matter of said claim may therefore be regarded as:

How to synchronise related trace information from different computer systems?

2.1.4 According to its abstract (as well as paragraph [0007], last sentence), the above objective technical problem is addressed by document D2. Hence, this document would be taken into account by a skilled person seeking to solve said problem. Steps 604-608 of Fig. 6 in D2 correspond to distinguishing feature 1. above, see also paragraphs [0088]-[0090]. Steps 704-708 of Fig. 7 in D2 correspond to distinguishing feature 2. above, see also paragraphs [0091]-[0093]. Paragraph [0075] of D2 disclose that "the information stored [...] may be used to reconstruct sequences of events within activities A and B and to synchronize streams of events". As is further illustrated by Fig. 10 (see paragraphs [0127]-[0130]), this results in a partial ordering of a first plurality of orderable events (ref. num 1000) versus a second plurality of orderable events (ref. num 1003), thereby disclosing distinguishing feature 3. above. Hence, said skilled person would arrive at the invention as defined by independent method claim 1 without the exercise of inventive skills.

2.2 Independent method claim 13

independent claim 13 effectively discloses the replaying of traces obtained by the method of claim 1. Since the replay of related traces from multiple processors is already known from D1 (see the passages thereof cited against claim 1) the subject-matter of independent claim 13 lacks an inventive steps for same reasons as independent claim 1.

2.3 Dependent claims 2-12 and 14-15

The additional subject-matter defined by dependent claims 2-12 and 14-15 is also known from or rendered obvious to a skilled person by the prior art as follows (numbers in the left column indicate the claims referred to):

- 2: The combined teachings of D1 and D2 are independent of the number of entities (threads) executed at any processor, and any suitable number of events occurring at one computer system can be involved the resulting (global) ordering of events.
- 3: The combined teachings of D1 and D2 apply to any amount of recording of executing entities. No inventive step can be attributed to recording only a partial execution.

- 4: The passages of D2 cited against claim 1 disclose recording in respect of receiving the message at the second entity. Only certain other types of events are recorded (see Fig. 10, ref. num 1003).
- 5, 6: D2, Fig. 8, steps 804 and 812.
- 7, 8: While the features of these claims are not found in the prior art it is not clear what technical effect could be attributed to these (arbitrary ?) choices for building the recorded first/second information. In particular it appears that this information does not allow for an unambiguous matching of send and corresponding receive actions.
- 9, 10, 14: To the extent a reply message could be identified as such (see Section VIII-1.1 below) the combined teachings of D1 and D2 apply to such messages as well.
- 11: To the extent this claim can be understood this is what is illustrated by Fig. 10 of D2.
- 12: See D1, paragraphs [0155]-[0156], execution by virtual machines (implying a hypervisor) being also disclosed, see e.g. paragraph [0043].
- 15: Obvious in view of Fig. 10 of D2.

Re Item VII

Certain defects in the international application

- 1 Contrary to the requirements of Rule 5.1(a)(i) PCT, page 1 of the description does not specify the technical field to which the present invention relates.
- 2 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in documents D1 - D3 is not mentioned in the description, nor are these documents identified therein.
- 3 The requirements of Rule 5.1(a)(iii) PCT are not met, because the summary section in the description starting on page 2 does not disclose the invention as claimed (e.g. by starting with a reference to the independent claims).

- 4 Independent claims 1 and 13 not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
- 5 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT). This applies to both the preamble and the characterising portion (see the PCT Guidelines, III-4.11).

Re Item VIII

Certain observations on the international application

- 1 Lack of clarity, Article 6 PCT

The present application does not meet the clarity requirement of Article 6 PCT, for the following reasons:

- 1.1 Claims 9-11 and 15

These claims relate to a "reply"-message, which implies a functional relationship with a previous message. However, said claims do neither define such relationship nor how a message can be identified as constituting a reply. In particular, it is not clear how a matching (claims 11, 15) between a reply message and another message can be performed.

Furthermore, due to a syntactical problem, the wording of claim 11 is not understandable.

- 1.2 Claim 12

This claim is obscure as it is not clear how a "machine boundary" can "comprise a hypervisor". It is further noted that the expression "computer system" (as opposed to "virtual machine") is understood as a physical entity. Thus, to the extent this is intended here, two distinct computer systems cannot be under control of a single hypervisor. Finally, independent claim 1 is understood as defining a distributed tracing in a system comprising at least two computer systems. As opposed to this, virtual machines under control of a common hypervisor do not form a distributed system.