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Datasheet for the decision
of 11 January 2021

Case Number: T 1701/15 - 3.5.01

Application Number: 09714605.4

Publication Number: 2248020

IPC: G06F11/07

Language of the proceedings: EN

Title of invention:
MANAGING USE OF STORAGE BY MULTIPLE PAGEABLE GUESTS OF A
COMPUTING ENVIRONMENT

Applicant:
International Business Machines Corporation

Headword:
MANAGING USE OF STORAGE BY MULTIPLE PAGEABLE GUESTS OF A
COMPUTING ENVIRONMENT/IBM

Relevant legal provisions:
EPC Art. 84, 123(2), 111(2)

Keyword:
Claims - clarity after amendment (yes)
Amendments - added subject-matter (no)
Appeal decision - remittal to the department of first instance
(yes)

Case Number: T 1701/15 - 3.5.01

D E C I S I O N
of Technical Board of Appeal 3.5.01
of 11 January 2021

Appellant: International Business Machines Corporation
(Applicant)   New Orchard Road
                          Armonk, NY 10504 (US)

Representative: Litherland, David Peter
                          IBM United Kingdom Limited
                          Intellectual Property Department
                          Hursley Park
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Decision under appeal: Decision of the Examining Division of the
                          European Patent Office posted on 9 January 2015
                          refusing European patent application No.
                          09714605.4 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman   W. Chandler
Members: N. Glaser
                C. Schmidt

Summary of Facts and Submissions

I.   This appeal is against the decision of the examining
        division to refuse the European patent application No.
        09714605.4 pursuant to Article 97(2) EPC on the grounds
        of lack of clarity (Article 84 EPC) and added subject-
        matter (Article 123(2) EPC).

II.   In the statement setting out the grounds of appeal, the
        appellant requested that the decision under appeal be
        set aside and that a patent be granted on the basis of
        claims 1 to 6 of a new request filed as Annex A. Oral
        proceedings were not requested.

III.   In a communication the Board set out its preliminary
        opinion that claim 1 of the new main request overcame
        the objections under Article 84 EPC and Article 123(2)
        EPC of the impugned decision, but that the amendments
        seemed to lead to further objections under Article 84
        and 123(2) EPC.

IV.   The appellant filed in response new claims 1 to 4 to
        replace previously filed claims 1 to 6 and description
        page 2 to replace pages 1a and 2.

V.   Claim 1 reads as follows :

        *"1. A method for executing an instruction, the method
        comprising the steps of*

        *obtaining a test protection machine instruction (900),
        the test protection machine instruction comprising an
        opcode field (902), a first operand (904, 906) and a
        second operand (908, 910); and*

executing (1000), by a pageable guest managed by a host, the test protection machine instruction, to determine one or more host and guest level storage protection attributes for a location of storage, the location of storage specifying a first host frame of host main storage, and wherein the first operand designates a logical address for the location of storage and the second operand designates an access key for testing against a storage key for the location of storage, the executing comprising:

determining (1002) whether storing to the storage location is permitted by both host and guest and on a positive determination, completing (1004) by setting a first condition code that represents a storage protection attribute to the pageable guest that fetching and storing to the location of storage is permitted;

on a negative determination with respect to storing to the storage location, determining (1006) whether guest and host address translation is available;

on a negative determination as to availability of guest address translation, completing (1008) by setting a second condition code that represents a storage protection attribute to the pageable guest that translation is not available, and on a negative determination as to availability of host address translation, completing (1012) by executing a host interrupt;

on a positive determination with respect to availability of both guest and host address translation, determining (1014), with reference to permissions stored at host and guest translation

tables, whether fetching from the storage location is permitted by both host and guest;

on a negative determination with respect to fetching from the storage location, completing (1016) by setting a third condition code that represents a storage protection attribute to the pageable guest that neither fetching from nor storing to the storage location is permitted;

on a positive determination with respect to fetching from the storage location, determining (1018) whether a host protection exception trap is enabled;

on a negative determination with respect to enabling of the host protection exception trap, completing (1020) by setting a fourth condition code that represents a storage protection attribute to the pageable guest that only fetching is permitted;

on a positive determination with respect to enabling of the host protection exception trap, determining (1022), with reference to the guest translation table, whether storing is permitted by the guest,

on a negative determination with respect to storing by the guest, completing (1024) by setting the fourth condition code,

on a positive determination with respect to storing by the guest, determining whether the host write protection is other than Dynamic Address Translation 'DAT';

on a positive determination with respect to host write protection being other than DAT, completing (1028) by setting the fourth condition code;

on a negative determination with respect to host write protection being other than DAT, intercepting (1030) execution of the test protection machine instruction, and in response to the step of intercepting, simulating, by a host dispatching the pageable guest, execution of the test protection machine instruction, the step of simulating comprising: determining (1040) whether the location of storage is part of a host copy-on-write scheme;

on a positive determination with respect to location of storage being part of a host copy-on-write scheme, completing (1044) by setting the first condition code representing to the pageable guest that storing to the location of storage is permitted, although host translation table entries for that location of storage remain unchanged; and

on a negative determination with respect to location of storage being part of a host copy-on-write scheme, completing (1042) by setting the fourth condition code."

Reasons for the Decision

1.   The invention

1.1   The invention manages the use of storage by multiple pageable guests of a computing environment, as in the IBM z/Architecture. A pageable guest is, for example, a virtual machine V=V model, in which the absolute or real memory of the virtual machine is backed by host

virtual memory, instead of real or absolute memory, see
page 5, second paragraph of the original application.
In these environments a portion of storge of a
computing environment is typically shared among a
plurality of processes executing within the
environment. Storage protections are applied to provide
data integrity.

1.2   In a pageable guest environment, where multiple guests
         share the same storage, this has the drawback that
         information relating to the protections becomes
         convoluted for the guests and/or the hosts executing
         the guests, see page 1, second to fourth paragraphs.
         There is a need for indicating whether a storage
         protection fault was due to host level protection or
         guest level protection.

1.3   The invention solves this problem of prior art systems
         by providing a capability that facilitates management
         of storage used by multiple pageable guests of a com-
         puting environment. A query instruction, called a Test
         Protection (TPROT) instruction, details the informa-
         tion regarding the area of storage indicated in the
         query, see page 4, second paragraph, and page 44, line
         25, to page 55, line 25. It provides indications about
         the protections of the storage and allows distinctions
         to be made between host level and guest level
         protections.

1.4   When a program allocates a storage frame, it learns the
         attributes of the frame, i.e. whether it is resident/
         not write protected, by executing a TPROT query which
         returns a condition code, see page 45, first paragraph;
         page 46, lines 23 to 29, details possible return codes.
         However, when the program is executing interpretively
         as a guest under the control of a host supervisor, the

return code may reflect the attributes from the frame from the viewpoint of the guest address translation tables, as well as the host translation tables. This may compromise the isolation provided by the hypervisor. Therefore, a copy-on-write (COW) scheme is used to reduce memory pressure by operation systems.

1.5   The invention inquires (Figure 10B: step 1040) whether the area in storage to be accessed is part of a host copy-on-write (COW) scheme, meaning that it cannot be written to, and provides a false return code indicating successful execution completion of the TRPOT instruction, although the translation tables are not updated to accommodate host copy-on-write (COW) scheme, see page 47, first paragraph. The approach has the advantage that the host does not need to change the state of its dynamic address translation (DAT) tables and the frame remains write-protected, see page 55, second paragraph.

2.   Articles 84 and 123(2) EPC

2.1   In the impugned decision, point 2.1, claim 1 was objec-ted to under Article 123(2) EPC because the "*testing of a location designated by the first operand for one or more storage protection exception conditions*" could be interpreted in that the execution of a TPROT instruc-tion leads to an actual exception being issued for which there was no basis, page 45, lines 1 to 11, and page 51, lines 19 to 21 and page 52, lines 3 to 5.

2.2   At point 2.2, claim 1 was further objected to under Article 84 EPC because the address translation mechanism was unclear. It did not clearly define a two-level address translation scheme involving guest and host translation tables, see page 45, lines 1 to 11, it

did not clearly indicate that the first operand of the
TPROT instruction is actually the subject of address
translation, page 48, line 10, and it did not clearly
relate the failure to perform an address translation
and the concept of exception, page 19, lines 10 to 12.
Furthermore, the expression " ... *although the location
of storage remains write-protected*" was inconsistent
with the rest of claim 1 which referred to a "copy-on-
write" protection scheme.

2.3   Claim 1 was substantially amended in appeal
        proceedings, based on pages 53 to 55 and Figures 10A
        and 10B of the application as filed. After additional
        objections by the Board, claim 1 was amended further
        including the incorporation of the features of claims 2
        and 3. The Board is satisfied that claim 1 of the
        present request overcomes the objections.

3.   Article 56 EPC

3.1   In an obiter dictum the division made a few general
        comments regarding lack of inventive step (Article 56
        EPC) over D3, but did not clearly identify the
        distinguishing features nor did it draw a definitive
        conclusion.

3.2   The appellant argued, point 2.8 of the grounds, that D3
        disclosed a test protection machine instruction (TPROT)
        which could be considered to indicate the protection of
        a location of storage. However, D3 did not disclose the
        details of its execution and in particular not the
        "*determining (1040)*" step as defined in claim 1.

3.3   The Board tends to agree that D3 does not disclose the
        details of the determining step (1040) which was
        further amended in appeal proceedings based on Figures

10A and 10B. While it seems that Test Protection
instructions (TPROT) were known, see page 45, lines 3
and 4, of the application, where IBM System z
processors use TPROT instructions and Sun Microsystems
mincore() instructions, there is no written evidence on
file to decide whether the distinguishing feature would
be inventive or not.

3.4   In the Board's view these arguments cannot be
          convincingly dealt with without knowledge of the way
          TPROT instructions are normally built. Since a prior
          art search has not yet been performed on this matter
          it is thus necessary to remit the case to the
          examining division for carrying out an additional
          search and for continuing the substantive examination
          on the basis of the present main request and the
          results of the additional search.

Order

For these reasons it is decided that:

1.   The decision under the appeal is set aside.

2.   The case is remitted to the department of first
          instance for further prosecution on the basis of
          claims 1 to 4 of the request filed with letter dated
          5 November 2020.

The Registrar: The Chairman:

T. Buschek   W. Chandler

Decision electronically authenticated