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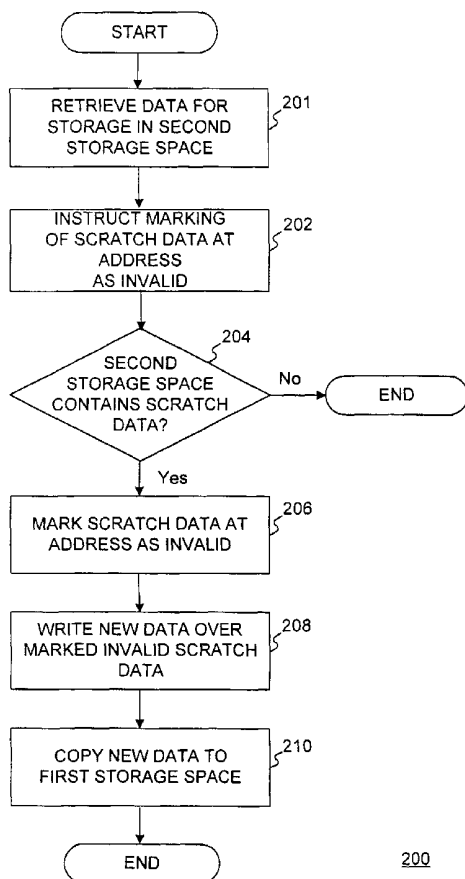
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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR INVALIDATION OF DATA IN COMPUTER SYSTEMS



(57) Abstract: Methods and systems consistent with this invention conserve computer resources in a hierarchical memory system by preventing scratch data from unnecessarily being copied from a lower hierarchy to a higher hierarchy storage space. Such methods and systems invalidate portions of data in the higher hierarchy storage space so that the coherence protocol does not copy the data to the lower hierarchy storage space. For example, methods and systems consistent with this invention hierarchically store data in a computer system having a main memory and a cache memory. Such methods and systems designate an area of the cache memory that contains scratch data as invalid, wherein the invalid data occupies less space than a maximum space of the cache memory, and permit a writing over of the invalid data in the cache memory.



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G06F12/08		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 G06F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 325 499 A (KUMMER DAVID A ET AL) 28 June 1994 (1994-06-28) column 8, line 35 -column 9, line 56; figure 1 column 5, line 36 - line 64 --- -/--	1-7,13, 14, 16-22, 29,30, 32-39, 42,43, 45,46, 48-51, 56-58, 60-63, 70,71, 73-76, 83,84
<input checked="" type="checkbox"/>	Further documents are listed in the continuation of box C.	<input checked="" type="checkbox"/>
Patent family members are listed in annex.		
° Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the International filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family	
Date of the actual completion of the international search	Date of mailing of the international search report	
13 March 2002	03.06.02	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Beker, H	

INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 5 636 374 A (KONIGSFELD KRIS G ET AL) 3 June 1997 (1997-06-03)</p> <p>column 12, line 56 - line 64; figure 2 ---</p>	<p>1-7,13, 14, 16-22, 29,30, 32-39, 42,43, 45,46, 48-51, 56-58, 60-63, 70,71, 73-76, 83,84</p>
X	<p>DE 199 34 515 A (INTEL CORP.) 27 January 2000 (2000-01-27)</p> <p>claims 1-5 -----</p>	<p>1-7,13, 14, 16-22, 29,30, 32-39, 42,43, 45,46, 48-51, 56-58, 60-63, 70,71, 73-76, 83,84</p>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/26075

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-7, 13, 14, 16-22, 29, 30, 32-39, 42, 43, 45, 46, 48-51, 56-58, 60-63, 70,
71, 73-76, 83-84

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-7, 13,14, 16-22,29,30,32-39,42,43,45,46, 48-51, 56,57-58,60-63,70,71,73-76,83-84

A method and apparatus for invalidating data in a memory hierachy

2. Claims: 8-12,23-28,40-41,44,52-55,64-69,77-82

A method and apparatus for invalidating pages in a virtual memory system using virtual memory on a disk

3. Claims: 15,31,47,59,72,85

A method and an apparatus for maintaining cache consistency in a non-uniform memory access system accessed from multiple processor, the term non-uniform memory access system interpreted in the manner defined in the description as filed on page 3 lines 21 to page 4 line 9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No PCT/US 01/26075
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Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
US 5325499	A	28-06-1994	NONE	
US 5636374	A	03-06-1997	NONE	
DE 19934515	A	27-01-2000	DE 19934515 A1	27-01-2000
			GB 2357873 A ,B	04-07-2001
			GB 2343029 A ,B	26-04-2000