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(54) **Title:** METHOD AND SYSTEM FOR MULTICAST STATISTIC COLLECTION

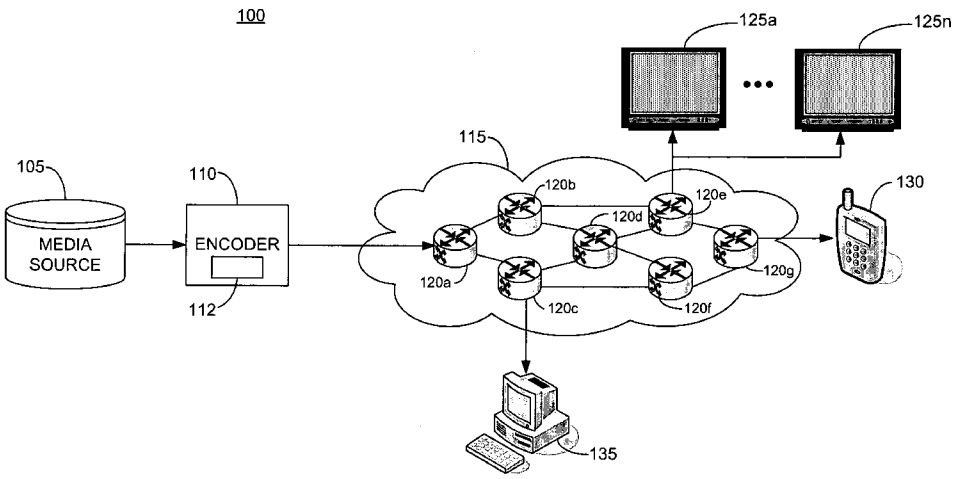


FIG. 1

(57) **Abstract:** A system (100) and method (200) related to gathering statistical information regarding a data stream. The method (200) may include sending (205), by a data forwarding device (110), an internet protocol (IP) multicast data stream to a multicast group using an internet protocol (IP); and collecting (210) statistical data from a router (120a - g) down stream of the forwarding device (110) to determine a number of end point recipients (125, 130, 135) associated with the multicast group and receiving the multicast data stream.

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METHOD AND SYSTEM FOR MULTICAST STATISTIC COLLECTION

BACKGROUND

Field

[0001] Embodiments may generally relate to methods and systems of multicasting. More particularly, some embodiments are concerned with collecting statistical data regarding recipients of multicast data streams.

Description

[0002] Multicasting of video may provide a mechanism to deliver video to a number of recipients simultaneously, creating copies of the data stream only where necessary. Multicasting may be used to broadcast media presentations in commercial, entertainment, and educational contexts. In some environments, a broadcast may be supported by or based on the number of recipients that receive the broadcast. These environments may include advertisement support commercial broadcasts, as well as educational and enterprise training scenarios where the institution or service organization rendering training services may need an accurate accounting of the entities receiving the video training

[0003] As such, there exist a need for a system, method, and computer executable program for collecting statistical data regarding recipients of multicast data streams.

SUMMARY

[0004] Some embodiments provide a system, method, device, program code and/or means to gather statistical information regarding a multicast data stream. The method may include sending, by a data forwarding device, an internet protocol (IP) multicast data stream to a multicast group using an internet protocol (IP); and collecting statistical data from a router down stream of the forwarding device to determine a number of end point recipients associated with the multicast group and receiving the multicast data stream.

[0005] A system according to embodiments herein may include a data forwarding device to send an IP multicast data stream to a multicast group using an internet protocol (IP); a router down stream of the forwarding device to route the multicast data stream the multicast group; and a collection device to collect statistical data from the down stream router to determine a number of end point recipients associated with the multicast group and receiving the multicast data stream.

[0006] In some embodiments, a medium having machine executable program instructions stored thereon includes instructions to send, by a data forwarding device, an internet protocol (IP) multicast data stream to a multicast group using an internet protocol (IP); and instructions to collect statistical data from a router down stream of the forwarding device to determine a number of end point recipients associated with the multicast group and receiving the multicast data stream.

[0007] With these and other advantages and features that will become hereinafter apparent, further information may be obtained by reference to the following detailed description and appended claims, and to the figures attached hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Some embodiments are illustrated in the accompanying figures, in which like reference numerals designate like parts, and wherein:

[0009] FIG. 1 is a representative block diagram of a system, according to some embodiments herein; and

[0010] FIG. 2 is a flow diagram of a process, according to some embodiments.

DETAILED DESCRIPTION

[0011] FIG. 1 is an illustrative block diagram of system 100 according to some embodiments herein. System 100 may be provided to deliver, facilitate,

improve, or enhance a multicast broadcast according to some embodiments. In some other embodiments, system 100 may include or be interfaced with a media source 105, an encoder 110, a data collection device 112, a transport network 115, and recipients 125a – 125n, 130, 135. Media source 105 may include live broadcasts, recorded presentations, store and forward broadcast, and other techniques and methods applicable for providing various forms of multimedia data. The multimedia data may be captured, obtained, or otherwise acquired for multicast broadcast in accordance with other aspects herein using a number of different techniques. For example, media source 105 may be video obtained using analog and video capture equipment, including standard definition and high definition processes, television broadcasts, and satellite communications.

[0012] The multimedia data obtained from video source 105 may be encoded to distribute video to end recipients 125a - n, 130, 135. Encoder 110 may be capable of processing and encoding various types and protocols of video signals, including but not limited to MPEG-4 data, a video coding standard by the ISO/IEC Moving Picture Experts Group (MPEG) under the formal standard ISO/IEC 14496.

[0013] In some embodiments herein, internet protocol (IP) data packets are multicast to multiple recipient destinations by encoder 110. A single copy of the data stream from media source 105 is forwarded to a group of recipients using a single IP address for the group, in accordance with multicast protocols and techniques. Data addressed to the single multicast group IP address is forwarded to each of a group interested recipients. Routers (e.g. 120a – 120g) may be used to route the data the recipients 125a - n, 130, 135. Using standardized multicast IP addressing protocols, a multicast group identifying the set of recipients interested in receiving a particular data stream may be represented by a single address according to a defined standard. Recipients interested in receiving the multicast data stream may join a multicast group using standard IP protocols that manage membership of the multicast group(s). Multicast group membership

discovery protocols herein may include, for example, Internet Group Management Protocol (IGMP), Multicast Listener Discovery (MLD), multicast of ATM (Asynchronous Transfer Mode), and others.

[0014] In accordance with embodiments herein, a multicast broadcast may use multicast addressing protocols that are now known and those that become known, multicast group membership discovery protocols that are now known and those that become known, and multicast routing protocols that are now known and those that become known. In some embodiments, the multicast routing protocols may include protocol independent Multicast Sparse Mode (PIM-SM), Protocol Independent Multicast Dense Mode (PIM-DM), and Distance Vector Multicast Routing Protocol (DVMRP). In some embodiments, a multicast routing protocol may generate a tree of recipients to indicate the recipients belonging to the multicast group(s).

[0015] It should be appreciated that a multicast group herein may include one, more, or none of the recipients 125a - n, 130, 135. It is also noted that more than one recipient may be connected to any one of routers 120a - g. That is, a plurality of recipients may be interfaced with any one of routers 120. For example, televisions 125a – 125n may form a multicast group and are connected to router 120e. A single multicast data stream (e.g., a movie broadcast) may be forwarded from encoder 110 via routers 120a and 120b to router 120e. At router 120e, the multicast data stream may be duplicated (as needed) and sent to each of the recipient televisions 125a –n belonging to the multicast group.

[0016] It is noted that recipient televisions 125a – 125n may include one or more recipient devices. FIG. 1 depicts only two such recipient devices, as a matter of clarity and not as a limitation. Similarly, additional recipient devices 130 may be connected to, for example, router 120g and additional recipient devices 135 may be connected to, for example, router 120c.

[0017] It should also be understood that while routers 120a – g are shown as a network of routers, other network and interconnection topographies and arrangements may be provided. For example, the routers 120a – g may

include more or fewer routing devices, be arranged in different configurations, and the connections between them (if any) may be provided on an ad hoc, selective, predetermined, variable, or reconfigurable basis. Thus, FIG. 1 is an example of a system embodiment provided to clearly illustrate various aspects of the present disclosure.

[0018] In some embodiments, encoder 110, though effective in encoding the multicast data stream, does not provide an efficient manner for accounting for or determining the specific recipients of the multicast broadcast. In some embodiments the IP protocols used, including the use and delivery of the multicast data stream to a single multicast group address precludes determining the number of eventual recipients of the multicast data stream at encoder 110.

[0019] In some embodiments herein, data is collected from routers (e.g., 120 a – g) downstream of encoder 110 that forwards the data stream to a designated multicast group address over network 115 for delivery to the multicast group(s) recipients by data collection device 112. In accord with embodiments herein, routers located downstream of encoder 110 and prior to recipients 125a - n, 130, 135 may be polled, queried, monitored, or otherwise viewed for the collection of data processed or available at the specific router to determine, for example, the number of recipients receiving a multicast broadcast. Aspects of the multicast addressing, multicast group membership discovery protocols, and multicast routing protocols may be leveraged to determine the number of recipients receiving the multicast data stream packets.

[0020] In some embodiments, information regarding a network address receiving the multicast data stream packets may be collected by data collection device 112 and used in the determinations herein. In some embodiments, information regarding a subnet address receiving the multicast data stream packets may be collected and used in the determinations herein.

[0021] In some embodiments, a router closest to the recipients of the multicast data stream may provide the data collected in the data collections

herein. For example, router 120c may provide data relating to a recipient connected thereto (e.g., host 135), router 120e may provide data relating to recipient 125a - n (e.g., televisions throughout an office park), and router 120g may provide data relating to a smartphone 135.

[0022] FIG. 2 is a flow diagram of process 200 according to some embodiments. Process 200 may be executed by system 100 using any suitable hardware and/or software arrangement, and may be executed by any suitable device or devices that are now known or become known.

[0023] At operation 205, a method for gathering statistical information regarding a data stream is facilitated by sending an IP multicast data stream to a multicast group using an internet protocol (IP) by a data forwarding device. As discussed above, this aspect of the method may be accomplished by encoder 110. In other embodiments, a device separate and distinct from encoder 110 may be used to provided the requisite functionality in connection with process 200. That is, the forwarding device may be part of or separate from encoder 110. It is also noted that the forwarding device may be implemented in hardware, software, and combinations thereof.

[0024] At operation 210, a process of collecting statistical data from a router down stream of the forwarding device to determine a number of end point recipients associated with the multicast group and receiving the multicast data stream is accomplished. This aspect of the method may be accomplished by data collection device 112. Referring to FIG. 1, routers 120a – g actively involved in the delivery of the multicast data stream to the particular recipients (e.g., 125 a - n, 130, 135) may have data collected therefrom.

[0025] The collected data may be further processed and analyzed to ascertain statistical data regarding the recipients of the multicast data stream. The forwarding device (e.g., encoder 110) may, in cooperation with data collection device 112, be involved with some, none, or all of the collected data analysis and processing. In some embodiments, the data collection device

112 is separate and distinct, functionally and physically, from the forwarding device.

[0026] In some embodiments, the methods and systems disclosed herein may be implemented by a combination of hardware and software components. In some aspects, the methods and systems may be accomplished, at least in part, using computing processors to execute computer code and program instructions stored on a memory (e.g., flash memory, RAM, ROM, disk drive, and other media) or otherwise accessible by the processor.

[0027] Embodiments described above are not intended to be limited to the specific form set forth herein, but are intended to cover such alternatives, modifications and equivalents as can reasonably be included within the spirit and scope of the appended claims.

CLAIMS

1. A method (200) for gathering statistical information regarding a data stream, the method comprising:

sending (205), by a data forwarding device (110), an internet protocol (IP) multicast data stream to a multicast group using an internet protocol (IP); and

collecting (210) statistical data from a router (120a - g) down stream of the forwarding device (110) to determine a number of end point recipients (125, 130, 135) associated with the multicast group and receiving the multicast data stream.

2. The method (200) of claim 1, wherein an end point recipient (125, 130, 135) joining the multicast group sends a message to the downstream router (120a - g) using a multicast group membership discovery protocol.

3. The method (200) claim 2, wherein the multicast group membership discovery protocol includes Internet Group management Protocol (IGMP) and Multicast Listener Discovery (MLD).

4. The method (200) of claim 1, wherein the collecting (210) of statistical data from the router (120a – g) down stream is based, at least in part, a multicast distribution tree of recipients.

5. The method (200) of claim 1, wherein a destination IP address for the multicast data stream is set to an address of the multicast group.

6. The method (200) of claim 1, wherein the collecting (210) of statistical data includes collecting data indicative of a network address receiving the multicast data stream.

7. The method (200) of claim 1, wherein the collecting (200) of statistical data includes collecting data indicative of a subnet address receiving the multicast data stream.

8. A system (100) for gathering statistical information regarding a data stream, the system comprising:

a data forwarding device (110) to send an internet protocol (IP) multicast data stream to a multicast group using an internet protocol (IP);

a router (120a – g) down stream of the forwarding device (110) to route the multicast data stream the multicast group; and

a collection device (112) to collect statistical data from the down stream router to determine a number of end point recipients (125, 130, 135) associated with the multicast group and receiving the multicast data stream.

9. The system (100) of claim 8, wherein an end point recipient (125, 130, 135) joining the multicast group sends a message to the downstream router (120a – g) using a multicast group membership discovery protocol.

10. The system (100) claim 9, wherein the multicast group membership discovery protocol includes Internet Group management Protocol (IGMP) and Multicast Listener Discovery (MLD).

11. The system (100) of claim 8, wherein the collecting of statistical data from the router (120a – g) down stream is based, at least in part, a multicast distribution tree of recipients.

12. The system (100) of claim 8, wherein a destination IP address for the multicast data stream is set to an address of the multicast group.

13. The system (100) of claim 8, wherein the collecting of statistical data includes collecting data indicative of a network address receiving the multicast data stream.

14. The system (100) of claim 8, wherein the collecting of statistical data includes collecting data indicative of a subnet address receiving the multicast data stream.

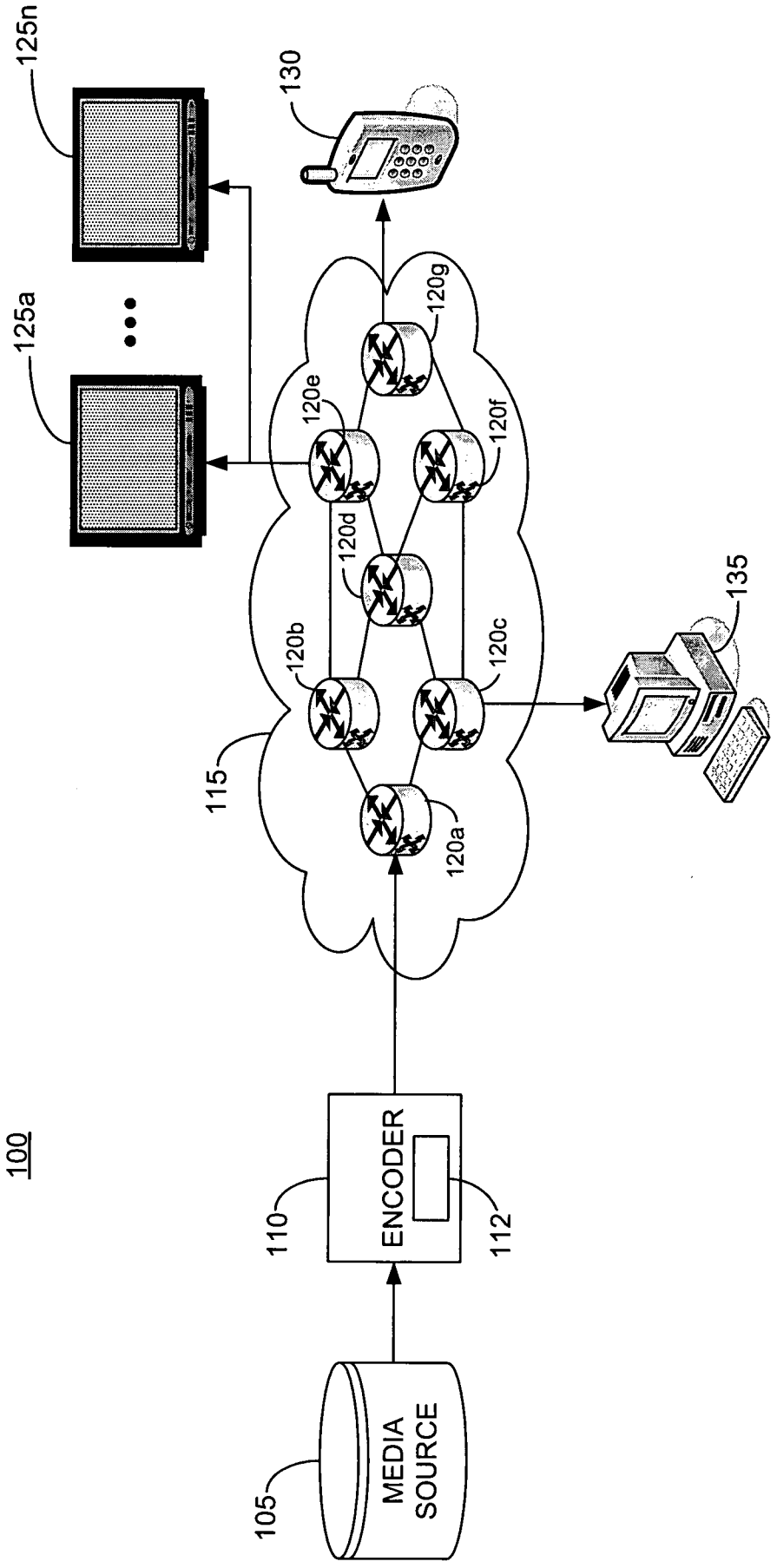

100
MEDIA SOURCE
105
ENCODER
110
112
115
120a
120b
120c
120d
120e
120f
120g
125a
125n
130
135

FIG. 1

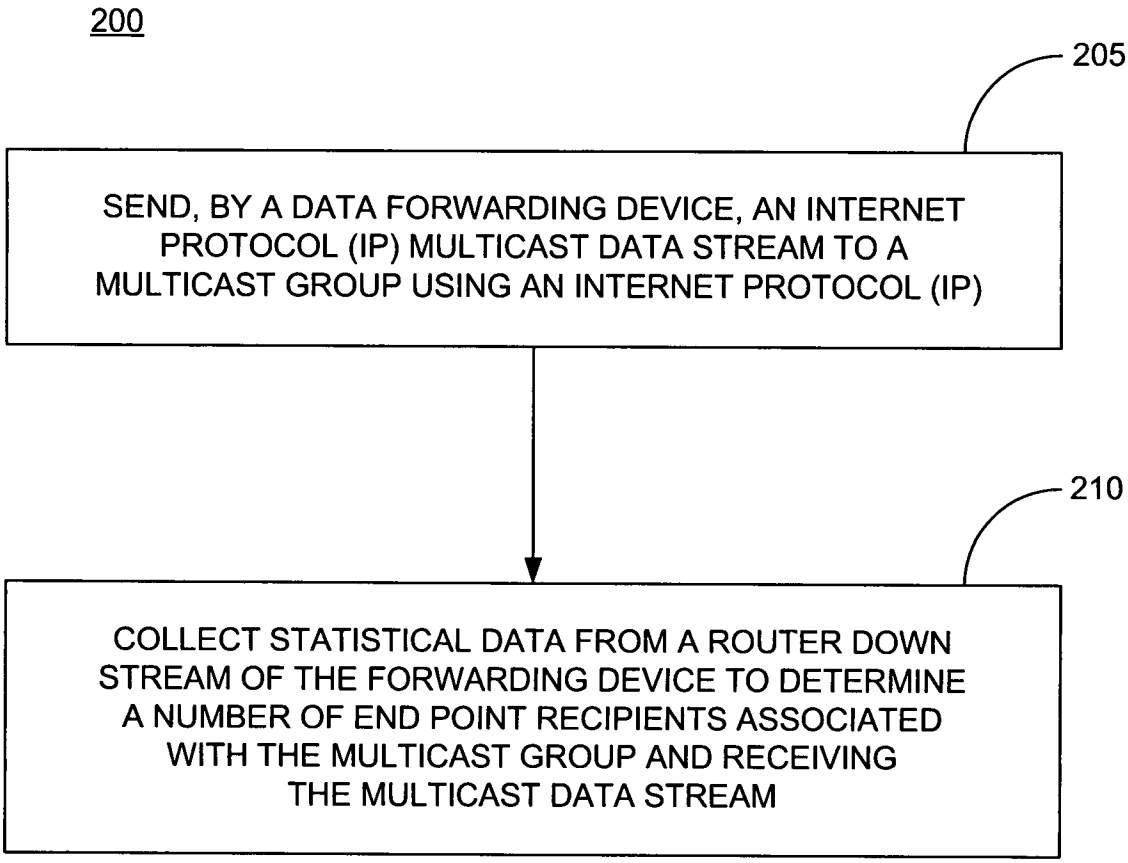

200
205
SEND, BY A DATA FORWARDING DEVICE, AN INTERNET PROTOCOL (IP) MULTICAST DATA STREAM TO A MULTICAST GROUP USING AN INTERNET PROTOCOL (IP)
210
COLLECT STATISTICAL DATA FROM A ROUTER DOWN STREAM OF THE FORWARDING DEVICE TO DETERMINE A NUMBER OF END POINT RECIPIENTS ASSOCIATED WITH THE MULTICAST GROUP AND RECEIVING THE MULTICAST DATA STREAM

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/022494

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/18 H04L12/24 H04L12/26

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)
H04L

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, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	EP 1 542 394 A (CIT ALCATEL [FR]) 15 June 2005 (2005-06-15) column 1 - column 47 claims 1-19	1-14
X	WO 2005/041456 A (ERICSSON TELEFON AB L M [SE]; ELTETO TAMAS [HU]; FARKAS JANOS [HU]; MA) 6 May 2005 (2005-05-06) page 3 - page 5	1-14

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family 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

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/022494

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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