(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 October 2012 (11.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/136005 A1

(51) International Patent Classification:
H04L 12/66 (2006.01)

(21) International Application Number:
PCT/CN2011/072552

(22) International Filing Date:
8 April 2011 (08.04.2011)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicants *(for all designated States except US)*: **ZTE CORPORATION** [CN/CN]; ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan, Shenzhen, Guangdong 518057 (CN). **ZTE CORPORATION** [FR/FR]; 114 Rue Galliéni, F-92100 Boulogne Billancourt (FR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **FOK AH CHUEN, Frédéric** [FR/FR]; 58 Rue De Sèvres, F-92100 Boulogne Billancourt (FR). **LI, Yu** [CN/CN]; 6/F, ZTE Plaza, No.35# Xing Guang Rd, New North Zone, Yubei, Chongqing 401121 (CN). **FAN, Wanpeng** [CN/CN]; 6/F, ZTE Plaza, No.35# Xing Guang Rd, New North Zone, Yubei, Chongqing 401121 (CN).

(74) Agent: **AFD CHINA INTELLECTUAL PROPERTY LAW OFFICE**; Suite B 1601A, 8 Xue Qing Rd., Haidian, Beijing 100192 (CN).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: A METHOD FOR ADDRESSING A M2M TERMINAL AND A M2M PLATFORM DEVICE

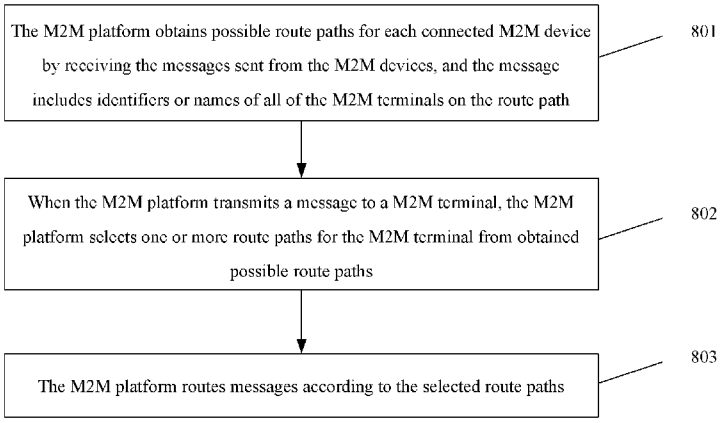

FIG. 8

(57) **Abstract**: The present invention discloses a method for addressing a Machine-to Machine (M2M) terminal, and the method comprising: a M2M platform obtaining possible route paths for each connected M2M terminal by received identifiers or names of all of the M2M terminals on the route path from an initiate M2M terminal to said M2M platform; when the M2M platform transmitting a message to a M2M terminal, selecting one or more route paths from the possible route paths; and the M2M platform routing messages according to selected route paths; wherein a M2M terminal is a M2M device or a M2M gateway. The present invention also discloses a M2M platform device. The present invention enables the M2M platform to get all possible route paths as well as an accurate route selection.

WO 2012/136005 A1

A METHOD FOR ADDRESSING A M2M TERMINAL AND A M2M PLATFORM DEVICE

Technical Field

The present invention relates to the wireless communication field, and particularly, to a method for addressing a M2M terminal and a M2M platform device.

Background of the Related Art

The Machine-to-Machine (M2M) communication refers to communication between entities without necessarily human intervention. The M2M platform provides the service Application Programming Interface (API), and the service API makes abstracting simpler. The M2M platform opens interfaces to applications, and provides operational management which includes (but not limited to): terminal management (such as software versions, and terminal status, etc.), customer application management (such as lifecycle deployment, and right permissions, etc.), message routing, and operational supports (such as billing, network statistics, error resiliency, and service availability, etc.). M2M terminals communicate with the M2M platform over wired or wireless networks.

A M2M terminal can be:

a M2M device, which is an end-node of a network communicating with sensors and/or actors. Wherein sensors gather information about the physical world while actors take decisions and perform adequate actions upon the environment. The M2M device implements the intelligence to receive events from sensors and to send orders to actors; or

a M2M Gateway, which serves as a go-between for the M2M platform and external sensors and/or actors networks (comprising M2M devices and/or M2M gateways). A M2M gateway can have different levels of intelligence and different packet inspections capabilities. The M2M Gateway is usually seen as a bridge between a Wide Area Network and one or multiple sensors and/or actors networks. The sensors and/or actors networks can communicate using different wired or wireless technologies, such as: ZigBee, X10, Power Line Communication, Bluetooth, and RF technologies, etc.

There is a need for the M2M platform (PF), as expressed in ETSI TS 102 690, to manage "Network Communication Service Selection" when a M2M device or a M2M gateway has several network addresses, taking into account the Request Service Class to be matched with available communication network paths and provide alternative communication paths according to selectable available communication networks. A reason for that is the cost of intermediary M2M gateways and M2M devices should remain low, so the addressing capabilities should be available on the M2M platform, meaning that M2M gateways and M2M devices should be reachable and managed by the M2M platform.

The above need is also expressed by some mobile operators as the need of supporting Capillary networks where M2M devices are reachable through multiple levels of M2M Gateways. For instance, as it is shown in FIG.1, the M2M devices D1.2.1 can be reached through the M2M Gateway 1(GW1) and the M2M Gateway 1.2 (GW1.2), namely, GW1 -> GW1.2 -> D1.2.1.

Besides, there is a need for handling the tree hierarchy of M2M terminals: both the M2M gateway and the M2M devices should be reachable and managed by the M2M platform.

FIG. 2 is a sketch map of a M2M area network in which the M2M gateway has a high level intelligence. As shown in FIG.2, in case a M2M gateway (the GW1 in FIG.2) has a high level intelligence, the M2M gateway can communicate with the M2M platform on behalf of the M2M devices, and therefore the M2M gateway has application level capabilities, for example authentication, registration, and message routing with protocol mediation (such as using different M2M protocol in the M2M sub area network, which includes the M2M gateway GW1, and M2M devices D1.1, D1.2 and D1.3 in FIG.2). For instance, the M2M gateway can interpret and inspect the protocol communication and trigger networks or application functions for authentication, or protocol mediation, etc.. Therefore the visibility of the M2M platform (the PF in FIG.2) is only for the M2M gateway, which means that all M2M devices are reachable through the address of the M2M Gateway. An address binding can be provided in the M2M platform, which associates a M2M device name (or the M2M device identifier) with the address of the M2M Gateway. The binding is either pre-provisioned or discovered when a M2M device

connects to the M2M platform. By adding the M2M device name (or the M2M device identifier) into the signaling messages, the M2M gateway GW1 is able to control, manage or receive events from the M2M devices within its sub area network, or sends events to the M2M devices in its sub area network, and acts as a "state M2M proxy" (which is for maintaining communication status and message delivery, potentially reformatting through protocol mediation, and so on). In this situation, it is up to the M2M gateway to maintain the knowledge of the M2M devices attached to its sub area network.

However when the M2M gateway has a low level intelligence, meaning that the M2M gateway only has network addressing capabilities, such as: name resolution, and address forwarding, the M2M Gateway acts as a router and cannot process the M2M protocol communication on behalf of the M2M devices within its sub area network (hereby "sub area network" refers as the M2M Local area network in FIG.3). In this situation, the M2M gateway does not make any transformation of the protocol communication technology used in the sub area network, and it just relays the messages to the M2M platform which has to understand and adapt to the protocol technology used. As shown in FIG.3, the M2M gateway GW1 has a low level intelligence. And M2M devices in the M2M sub area network of the GW1 include a D1.1, D1.2 and D1.3. The D1.1, D1.2 and D1.3 are reachable through the GW1 address. By adding the M2M device name (or the M2M device identifier) into the signaling messages, the M2M gateway GW1 is able to route the message. Name resolution enables the M2M Gateway to transfer the request to the M2M devices, and this is dependent upon the technology used (such as IP, Zigbee, X10, PLC, and 6LowPan, etc.) in the sub area network (i.e. M2M Local Area Network in FIG.3).

In FIG. 3, after receiving the M2M device identifier (or the M2M device name) contained in signaling messages, the M2M Gateway GW1 has to perform some additional works to know where to route the request. Indeed the M2M device identifier (or the M2M device name) is just a representation of the M2M device while its address is dependent upon the device technology used (such as IP, X10, 6LowPan, etc.).

The M2M Gateway GW1 does not perform the routing decisions in the prior art in this

situation, it just relays the message based on address resolution.

Therefore, when the M2M gateway has a low level intelligence, the M2M platform has to calculate the best route to reach the M2M device, and provide information to all intermediary M2M gateways (e.g. GW1, GW1.2 in FIG.3) so that those M2M gateways are able to relay messages to one or more M2M terminals.

In a Web Architecture, M2M terminals can have a Universal Resource Identifier (URI). The M2M terminals can be seen as a resource identified by a URI on a server (which is advantageously located in the M2M platform). Through the name resolution, the M2M platform can find the authority address and join the first M2M gateway (for example GW1) to which the request is sent. Since the URI representation may contain other M2M gateways along the path (e.g. "GW1 -> GW1.2 -> D1.2.1"), and then the GW1 analyzes the URI in the request to forward the request to the M2M gateway GW1.2 which in turn forwards the request to the M2M device D1.1. This URI representation needs to be provisioned in the M2M platform so that the M2M platform can join the M2M device D1.1. However if a M2M device changes its network attachment to a new M2M gateway, or can be joined via multiple M2M gateways, then a list of all possible route paths shall be maintained as well as an accurate route selection, and more particularly if a M2M gateway becomes faulty or if the quality (such as bandwidth, bit rate, etc.) is degrading, and there is no such a technical scheme how to get all possible route paths as well as an accurate route selection for the M2M platform.

There is therefore a need (or an issue), for the M2M platform, of optimized addressing and network route path calculation.

Summary of the Invention

The technical problem to be solve in the present invention is to provide a method for addressing a M2M terminal and a M2M platform device, which enables the M2M platform get all possible route paths as well as an accurate route selection, especially for non-intelligence or low-intelligence M2M gateways.

In order to solve above technical problem, the present invention provides a method for

addressing a Machine-to Machine (M2M) terminal, and the method comprising:

a M2M platform obtaining possible route paths for each connected M2M terminal by received identifiers or names of all of the M2M terminals on the route path from an initiate M2M terminal to said M2M platform;

when the M2M platform transmitting a message to a M2M terminal, selecting one or more route paths from the possible route paths; and

the M2M platform routing messages according to selected route paths; wherein a M2M terminal is a M2M device or a M2M gateway.

Wherein the step of a M2M platform obtaining possible route paths for each connected M2M terminal comprises:

the M2M platform receiving a message initiated by a M2M terminal, said message carrying the identifier or name list of father nodes of said M2M terminal together with the identifier or name of said M2M terminal, and said M2M platform obtaining and recording a father and child relationship for said M2M terminal; wherein all the father and child relationships of one M2M terminal are the possible route paths for said M2M terminal.

Wherein in the step of the M2M platform receiving a message initiated by a M2M terminal, a stack of terminal identifiers in said message carries the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal.

Wherein the step of the M2M platform receiving a message initiated by a M2M terminal comprises:

when a M2M device initiates a message to said M2M platform, the M2M device sending a message which includes its own identifier in the stack of terminal identifiers in the message to a father node, wherein said father node is an intermediary M2M gateway or the M2M platform;

if the father node is an intermediary M2M gateway, the intermediary M2M gateway receiving the message from the M2M device or other intermediary M2M gateway, the intermediary M2M gateway adding its own identifier in the stack of terminal identifiers, which also includes the identifier of the M2M device, and then sending the message to a father node of the intermediary M2M gateway, wherein the father node of the intermediary M2M gateway is

the M2M platform or another intermediary M2M gateway; and

the M2M platform receiving the message sent by an intermediary M2M gateway or a M2M device.

Wherein in the step of selecting a route path from the possible route paths, the M2M platform selects one or more route paths for the M2M terminal based on the Quality of Service (QoS) and/or availability information of the route paths, or the M2M platform selects one or more route paths indicated by the M2M terminal.

Wherein the way of the M2M platform selecting the route paths for each M2M terminal based on the QoS and/or availability information of the route comprises:

the M2M platform retrieving the route paths the M2M terminals indicated by terminal identifiers or terminal names; checking status of the M2M terminals in the route path, and if a M2M terminal is fault, the M2M platform looking up the other online father nodes of the M2M terminal to reach and calculating selection priorities according to a weighted sum of route path information, and selecting the maximal selection priority route path.

After the step of calculating selection priorities according to weighted sum of path information, the method further comprises: the M2M platform updating the father and child relationships for said M2M terminal recorded in the M2M platform.

Wherein the weighted sum of the route path information is equal to a weighted sum of the bandwidth, 1/load and 1/ (nodes number).

The method further comprising: the M2M platform monitoring status of all the M2M terminals according to one or more of following information: heartbeat, status reporting and fault reporting messages.

In order to solve above technical problem, the present invention also provides a M2M platform device, which comprises:

a route path obtaining module, which is configured to obtain possible route paths for each connected M2M terminal by received identifiers or names of all of the M2M terminals on the route path from an initiate M2M terminal to said M2M platform device;

a selection module, which is configured to when the M2M platform device transmits a

message to a M2M terminal, select one or more route paths from the possible route paths; and

a routing module, which is configured to route messages according to selected route paths;

wherein a M2M terminal is a M2M device or a M2M gateway.

Wherein the route path obtaining module is configured to obtain possible route paths for each connected M2M terminal as following way:

the route path obtaining module receiving a message sent by a M2M terminal, said message carrying the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal, and said route path obtaining module obtaining and recording a father and child relationship for said M2M terminal; wherein all the father and child relationships of one M2M terminal are the possible route paths for said M2M terminal.

Wherein a stack of terminal identifiers in said message carries the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal.

Wherein selection module is configured to select a route path from the possible route paths the M2M terminal as following way: the selection module selecting one or more route paths for the M2M terminal based on the Quality of Service (QoS) and/or availability information of the route paths, or the selection module selecting one or more route paths indicated by the M2M terminal.

Wherein the selection module is configured to select the route paths for each M2M terminal based on the QoS and/or availability information of the route as following way:

the selection module retrieving the route paths for the M2M terminals indicated by terminal identifiers or terminal names; checking status of the M2M terminals in the route path, and if a M2M terminal is fault, the selection module looking up the other online father nodes of the M2M terminal to reach and calculating selection priorities according to a weighted sum of route path information, and selecting the maximal selection priority route path.

The selection module is also configured to monitor status of all the M2M terminals according to one or more of following information: heartbeat, status reporting and fault reporting message.

The method and the M2M platform in present invention associates to Level4 protocol routing, and the present invention is for optimizing and calculating the M2M network route paths by the M2M platform, and for addressing the M2M devices behind multiple M2M gateways over multi-access networks. Compared with the prior art, the present invention further allows the M2M platform knowing the routes that are currently active, i.e. the route paths through which are sent messages between the M2M platform and M2M terminals, especially for non-intelligence or low-intelligence M2M gateways.

Brief Description of Drawings

FIG. 1 is a sketch map of a Tree-based M2M area network;

FIG.2 is a sketch map of the M2M area network in which a M2M gateway has a high level intelligence;

FIG.3 is a sketch map of the M2M area network in which a M2M gateway has a low level intelligence;

FIG.4 is a sketch map of the M2M overlay wide area network on top of a multi-access network;

FIG.5 is a sketch map of the message transmission from a M2M device according to an example of the present invention;

FIG.6 is a sketch map of the Routing via GW hierarchy according to an example of the present invention;

FIG.7 is a sketch map of messages transmission according to an example of the present invention;

FIG. 8 is a flow chart of the method for addressing a M2M terminal according to the present invention;

FIG. 9 is a sketch map of the structure of the M2M platform device according to the example of the present invention.

Preferred Embodiments of the Present Invention

Proposed invention is particularly adapted for signaling communication protocols over well known transport protocols like the User Datagram Protocol (UDP) or the Transmission Control Protocol (TCP). It can be adapted in protocols like the Wireless Machine-to-Machine Protocols for Terminal side (WMMP-T) or the Machine-to-Machine Data Management Protocol (MDMP) which are M2M protocols defined in China. The proposed invention also has a wider scope in the field of M2M addressing and routing capabilities, namely, addressing and routing capabilities in a multi-access network environment. The multi-access network environment refers to the agnostic communication capability of exchanging messages over both Fixed (such as Broadband network) and Mobile networks (such as the General Packet Radio Service (GPRS), Universal Mobile Telecommunications System (UMTS), Long Term Evolution (LTE), Worldwide Interoperability for Microwave Access (WiMAX), and so on).

Below it will describe the examples of the present invention with reference to figures in details. It should be noted that the examples and the features in the examples can be combined arbitrarily in the condition of without conflict.

FIG.4 is a sketch map of the M2M overlay wide area network on top of a multi-access network. The multi-access network is composed of different network nodes enabling the network communication over fixed or mobile network infrastructures, which are independent of the application communication protocols used. Some of those network nodes in the multi-access network may also be M2M gateway nodes in the plane of the M2M Overlay Wide Area Network. The M2M platform has a view of the M2M overlay wide area network, which is independent of the network communication protocols.

The method for addressing a M2M terminal according to the present invention is shown in FIG. 8, and the method comprises:

Step 801: the M2M platform obtains possible route paths for each connected M2M device by receiving the messages sent from the M2M devices, and the message includes identifiers or names of all of the M2M terminals on the route path, wherein the possible route paths are currently active route paths for each connected M2M terminal;

Step 802: when the M2M platform transmits a message to a M2M terminal, the M2M

platform selects one or more route paths for the M2M terminal from obtained possible route paths;

Step 803: the M2M platform routes messages according to the selected route paths.

Preferably, the M2M platform selects one or more route paths for the M2M based on the Quality of Service (QoS) and/or Availability information of the route paths.

The way of the M2M platform obtaining possible route paths for each connected M2M terminal comprises:

A M2M terminal sending a register message carrying the identifiers (IDs) list of the father nodes of the M2M devices and the identifier or name of the M2M device itself, and the M2M platform recording the father-child relationship for all nodes (including M2M gateways and M2M devices). Wherein the IDs list above is a list including the father nodes' identifiers or the father nodes' names. And the father node refers to the intermediary M2M gateways that transmit the message sent by a M2M device or a M2M gateway to the M2M platform.

Preferably, the way of the M2M platform obtaining the currently active route paths of a M2M terminal comprises:

In a protocol message, a stack of terminal identifiers being added into the protocol message, and the stack carrying the names or identifiers of the intermediary gateways' and the M2M terminal who initiates the protocol message.

The principle of adding the stack of terminal identifiers in the protocol message is as following (taking the identifier as an example to describe):

For the messages initiated by a M2M device:

The M2M device sends a message which includes its own identifier in the stack of terminal identifiers in the message to an intermediary M2M gateway or the M2M platform;

If the message initiated by the M2M device is received by an intermediary M2M gateway, the intermediary M2M gateway adds its own identifier in the stack of terminal identifiers in the message initiated by the M2M device, which also includes the identifier of the M2M device, and then sends the message to the M2M platform or another intermediary M2M gateway;

Preferably, when the M2M platform receives the protocol message including the stack of terminal identifiers transmitted by a M2M device or an intermediary M2M gateway, the M2M platform can obtain the currently active route paths of the M2M according to the identifiers in the stack of terminal identifiers in the message. And in this way, the M2M platform has a dynamic view of current active route paths for each connected M2M device because the M2M platform knows which route path being used by a M2M device.

For messages initiated by the M2M platform:

The M2M platform sends a message including the route path which is denoted by the identifiers or the names of the M2M terminals on the route path, and the M2M device can be reached by the route path. The route path is either the one indicated by the M2M devices or one that is selected as described below.

The way the M2M platform selecting the route paths for each M2M terminal based on the QoS and/or Availability information of the route comprises:

the M2M platform retrieving the route path indicated by the M2M terminals and checking the nodes' status in the route path, and if a node is fault, the M2M platform looking up the other online father nodes of the M2M terminal to reach and calculate the selection priority according to weighted sum of the bandwidth, load, and nodes number, wherein the node with maximal selection priority is selected as spare route; and

the M2M platform updating the IDs list of the father nodes stored in the M2M platform.

As shown in FIG. 5, a M2M device D1.2.1 sends a message to the M2M gateway GW1.2, carrying the identifier 1.2.1 of the M2M device in the stack of terminal identifiers in the message; and the M2M gateway GW1.2 adds the identifier 1.2 of the M2M gateway GW1.2 into the stack of terminal identifiers in the message, and then sends the message to the gateway GW1; the gateway GW1 adds its term, namely identifier 1 of the gateway GW1, into the stack of terminal identifiers in the message, and then sends to the M2M platform. Therefore, the M2M platform has the route path of the M2M device D1.2.1.

Preferably, the M2M platform can also retrieve the QoS parameters of the intermediary M2M gateways, as shown in FIG. 6.

FIG.6 illustrates the mechanism of the dynamic route paths made by the M2M platform. The M2M device D1.1.1 has three father nodes including the GW1.1, GW2 and GW3.1 (Notes: the father nodes information has been set in the M2M device manually during installation, and thus the M2M device has the father nodes information). When the M2M device registers to the M2M platform, the register message sent by the M2M device carries the IDs list of the father nodes, and the M2M platform records the father-child relationship for all nodes (including M2M gateways and M2M devices). The M2M platform can also monitor status of all the nodes according to one or more of following information: heartbeat, status reporting and fault reporting messages and so on.

Suppose the M2M device D1.1.1 first registers to the M2M platform through the GW1.1 and the GW1, the M2M platform records the current route path to the D1.1.1 as (@1, @1.1, @1.1.1). When a message requires to be sent to the D1.1.1 from the M2M platform, the M2M platform checks the nodes' status in the route path. If a node (for example, GW1.1) is fault, the M2M platform looks up the other online father nodes of the D1.1.1, and calculates the selection priority according to weighted sum of the bandwidth by 1/load and 1/(nodes number). The nodes with maximal selection priority will be selected as a spare route path.

The M2M platform maintains a tree hierarchy structure of said M2M device identifiers. As a M2M device may be reachable through potentially different route paths, the route path is selected based on QoS and/or Availability information (such as the number of hops, link QoS, available bandwidth, etc.) provided by the intermediary M2M gateways. Therefore it is possible for the M2M platform to route messages depending on the level of priority. For instance, alarm or urgent requests may be sent via a specific route path, while other messages are transmitted over different route paths. Besides, the M2M platform can also use other technique to select the best route path based on priority level of the M2M devices, such as well known flooding technique can be employed with a configurable maximum number of hops to avoid infinite loops

etc.

For sake of clarity, following example is described.

In FIG. 7, the PF or M2M terminals either can be recipients or can be the initiator depending on who initiates the message.

As shown in FIG. 7, the process of the M2M terminal message transfer including:

Step A:

Based on an identifier extracted from a M2M message, the M2M terminal performs name resolution (i.e. association between IP address <-> Identifier) to obtain the address of the next M2M gateway (or the next M2M platform); and

the message is forwarded to the next M2M Terminal or the M2M platform corresponding to the identifier.

For a M2M gateway:

When a M2M gateway receives a message from the M2M platform, the M2M gateway inspects the stack of terminal identifiers in the message, and performs as following:

If the first identifier in the stack of terminal identifiers is the M2M gateway's own identifier and the stack of terminal identifiers is then empty (namely, there is only the identifier of the M2M gateway in the stack of terminal identifiers), the message is for this M2M gateway itself. The message is consumed (namely the message is treated and not forwarded to any other nodes). If the first identifier in The Stack is not its own identifier, the M2M Gateway extracts this identifier, and carries out Step A;

If the first identifier in the stack of terminal identifiers is its own identifier but the stack of terminal identifiers also contains other identifiers, the M2M Gateway unpacks its own identifier, extracts the next identifier from the M2M message and carries out the Step A.

For a M2M device:

When a M2M device receives a message from a M2M gateway, the M2M device performs as following:

the M2M device inspects the stack of terminal identifiers in said message, and

If the identifier in the stack of terminal identifiers is the M2M device's own identifier, the message is consumed;

If the identifier in the stack of terminal identifiers is not the M2M device's own identifier, the M2M device rejects this message. In this case, The M2M device does not forward the message to avoid network flooding. However, the M2M device may reply a non-acknowledgment message to the M2M gateway that sends the message to indicate the error. This can help the M2M gateway to avoid repetitive device flooding and refine/recover the identifier list.

If there is not only one identifier in the stack of terminal identifiers, something wrong happens as the device should be an end-node.

When a M2M device sends a message to a M2M gateway, the M2M gateway adds its own identifier in the stack of terminal identifiers in the message.

The M2M device is configured with network address of the M2M platform used as the recipient; and

The M2M device is configured with at least one IDs list of the Father nodes. This list may be configured during device initial provisioning, or updated through the Over-The-Air methods (SMS Push, HTTP, etc.) and so on.

For the M2M platform:

When the M2M platform sends a message to a M2M terminal, the M2M platform retrieves the route path, comprising:

If the M2M terminal supports sending a registration message: the M2M terminal sending a register message carrying the IDs list of the father nodes of the device, and the M2M platform recording the father-child relationship for all nodes (including M2M gateways and M2M devices).

Otherwise, the M2M platform is provisioned with default or alternative father-child relationship for all nodes.

After the M2M platform obtains all possible route paths for all M2M terminals， the M2M platform performs a route selection process, comprising:

Based on the network monitored information, the M2M platform can choose a network route path to reach a M2M terminal depending on the message priority, desired QoS, or node Availability and so on along the route path.

After the M2M platform performs a route selection process, the M2M platform sends a message to the M2M terminal (device or gateway) including the path route.

Without network monitored knowledge, a default route path is used to reach the M2M device, or using alternative transmission means, such as sending a short message (SMS) to a M2M device if the M2M device supports the SMS bearer.

Many works exist in the field of network routing. Flooding or routing techniques like the RIP, OSPF, and BGP are usually applied on the low layer or relying on very specific network technologies. It is therefore difficult to have wide view of a network topology.

As shown in FIG. 9, the example of the present invention also provides a M2M platform device, which includes:

a route path obtaining module 901, which is configured to obtain one or more possible route paths for each connected M2M terminal by received identifiers or names of all of the M2M terminals on the route path from an initiate M2M terminal to said M2M platform;;

a selection module 902, which is configured to when the M2M platform transmits a message to a M2M terminal, select one or more route paths from the possible route paths; and

a routing module 903, which is configured to route messages according to selected route paths;

wherein a M2M terminal is a M2M device or a M2M gateway.

Preferably, the route path obtaining module 901 is configured to obtain possible route paths for each connected M2M terminal as following way:

the route path obtaining module 901 receiving a message sent by a M2M terminal, said message carrying the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal, and said route path obtaining module 901 obtaining and recording father and child relationships for said M2M terminal; wherein all the father and child relationships of one M2M terminal are the possible route paths for said M2M terminal.

Preferably, a stack of terminal identifiers in said message carries the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal.

The selection module 902 is configured to select a route path from the possible route paths the M2M terminal as following way: the selection module 902 selecting one or more route paths for the M2M terminal based on the Quality of Service (QoS) and/or availability information of the route paths, or the selection module 902 selecting one or more route paths indicated by the M2M terminal.

The selection module 902 is configured to select the route paths for each M2M terminal based on the QoS and/or availability information of the route as following way:

the selection module 902 retrieving the route paths for the M2M terminals indicated by terminal identifiers or terminal names; checking status of the M2M terminals in the route path, and if a M2M terminal is fault, the selection module 902 looking up the other online father nodes of the M2M terminal to reach and calculating selection priorities according to a weighted sum of route path information, and selecting the maximal selection priority route path.

The selection module 902 is also configured to monitor status of all the M2M terminals according to one or more of following information: heartbeat, status reporting and fault reporting messages.

The proposed approach relates to the M2M communication over multi access networks, but it is not limited to the multi access networks. Proposed invention differentiates from other

research in that it focuses on large scale network of M2M terminals, providing means for message routing on capillary networks to achieve optimized route path selection thereby offering means for operators or carriers to choose different paths while having knowledge of currently active routes to reach M2M terminals. The route selection can be based on required end-to-end quality of service, availability of nodes along the path to reach one or more M2M terminals, switching from one route to another.

Industrial Applicability

The method and the M2M platform device in present invention associates to Level4 protocol routing, and the present invention is for optimizing and calculating the M2M network route path by the M2M platform, and for addressing the M2M devices behind multiple M2M gateways over multi-access networks. Compared to prior art, the method further allow the M2M platform knowing the routes that are currently active, i.e. the route through which are sent messages between the M2M platform and M2M terminals, especially for non-intelligence or low-intelligence M2M gateways.

CLAIM

What we claim is:

1. A method for addressing a Machine-to Machine (M2M) terminal, and the method comprising:

a M2M platform obtaining possible route paths for each connected M2M terminal by received identifiers or names of all of the M2M terminals on the route path from an initiate M2M terminal to said M2M platform;

when the M2M platform transmitting a message to a M2M terminal, selecting one or more route paths from the possible route paths; and

the M2M platform routing messages according to selected route paths; wherein a M2M terminal is a M2M device or a M2M gateway.

2. The method as claimed in claim 1, wherein the step of a M2M platform obtaining possible route paths for each connected M2M terminal comprises:

the M2M platform receiving a message initiated by a M2M terminal, said message carrying the identifier or name list of father nodes of said M2M terminal together with the identifier or name of said M2M terminal, and said M2M platform obtaining and recording a father and child relationship for said M2M terminal; wherein all the father and child relationships of one M2M terminal are the possible route paths for said M2M terminal.

3. The method as claimed in claim 2, wherein in the step of the M2M platform receiving a message initiated by a M2M terminal, a stack of terminal identifiers in said message carries the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal.

4. The method as claimed in claim 3, wherein the step of the M2M platform receiving a message initiated by a M2M terminal comprises:

when a M2M device initiates a message to said M2M platform, the M2M device sending a message which includes its own identifier in the stack of terminal identifiers in the message to a father node, wherein said father node is an intermediary M2M gateway or the M2M platform;

if the father node is an intermediary M2M gateway, the intermediary M2M gateway

receiving the message from the M2M device or other intermediary M2M gateway, the intermediary M2M gateway adding its own identifier in the stack of terminal identifiers, which also includes the identifier of the M2M device, and then sending the message to a father node of the intermediary M2M gateway, wherein the father node of the intermediary M2M gateway is the M2M platform or another intermediary M2M gateway; and

the M2M platform receiving the message sent by an intermediary M2M gateway or a M2M device.

5. The method as claimed in claim 1 or 2 or 3 or 4, wherein in the step of selecting a route path from the possible route paths, the M2M platform selects one or more route paths for the M2M terminal based on the Quality of Service (QoS) and/or availability information of the route paths, or the M2M platform selects one or more route paths indicated by the M2M terminal.

6. The method as claimed in claim 5, wherein the way of the M2M platform selecting the route paths for each M2M terminal based on the QoS and/or availability information of the route comprises:

the M2M platform retrieving the route paths the M2M terminals indicated by terminal identifiers or terminal names; checking status of the M2M terminals in the route path, and if a M2M terminal is fault, the M2M platform looking up the other online father nodes of the M2M terminal to reach and calculating selection priorities according to a weighted sum of route path information, and selecting the maximal selection priority route path.

7. The method as claimed in claim 6, and after the step of calculating selection priorities according to weighted sum of path information, the method further comprising: the M2M platform updating the father and child relationships for said M2M terminal recorded in the M2M platform.

8. The method as claimed in claim 6, wherein the weighted sum of the route path information is equal to a weighted sum of the bandwidth, 1/load and 1/ (nodes number).

9. The method as claimed in claim 6, and the method further comprising: the M2M platform monitoring status of all the M2M terminals according to one or more of following information: heartbeat, status reporting and fault reporting messages.

10. A M2M platform device, which comprises:

a route path obtaining module, which is configured to obtain possible route paths for each connected M2M terminal by received identifiers or names of all of the M2M terminals on the route path from an initiate M2M terminal to said M2M platform device;

a selection module, which is configured to when the M2M platform device transmits a message to a M2M terminal, select one or more route paths from the possible route paths; and

a routing module, which is configured to route messages according to selected route paths;

wherein a M2M terminal is a M2M device or a M2M gateway.

11. The device as claimed in claim 10, wherein the route path obtaining module is configured to obtain possible route paths for each connected M2M terminal as following way:

the route path obtaining module receiving a message sent by a M2M terminal, said message carrying the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal, and said route path obtaining module obtaining and recording a father and child relationship for said M2M terminal; wherein all the father and child relationships of one M2M terminal are the possible route paths for said M2M terminal.

12. The device as claimed in claim 11, wherein a stack of terminal identifiers in said message carries the identifier or name list of the father nodes of said M2M terminal along with the identifier or name of said M2M terminal.

13. The device as claimed in claim 10, wherein selection module is configured to select a route path from the possible route paths the M2M terminal as following way: the selection module selecting one or more route paths for the M2M terminal based on the Quality of Service (QoS) and/or availability information of the route paths, or the selection module selecting one or more route paths indicated by the M2M terminal.

14. The device as claimed in claim 13, wherein the selection module is configured to select the route paths for each M2M terminal based on the QoS and/or availability information of the route as following way:

the selection module retrieving the route paths for the M2M terminals indicated by terminal identifiers or terminal names; checking status of the M2M terminals in the route path, and if a

M2M terminal is fault, the selection module looking up the other online father nodes of the M2M terminal to reach and calculating selection priorities according to a weighted sum of route path information, and selecting the maximal selection priority route path.

15. The device as claimed in claim 14, wherein the selection module is also configured to monitor status of all the M2M terminals according to one or more of following information: heartbeat, status reporting and fault reporting messages.

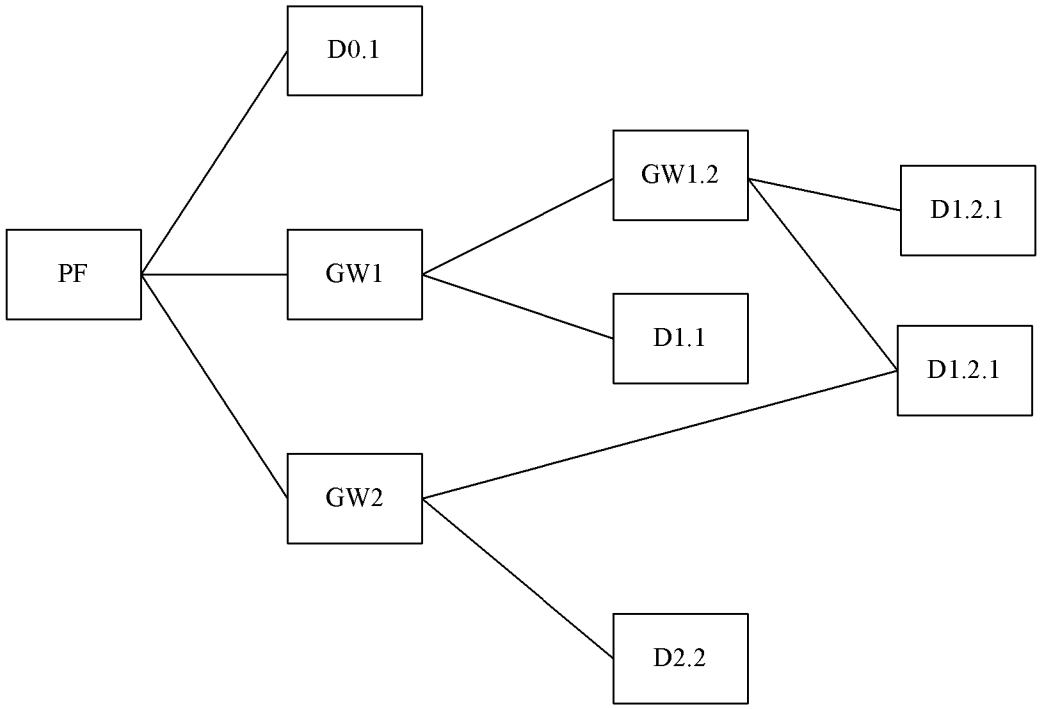
D0.1
GW1.2
D1.2.1
PF
GW1
D1.1
D1.2.1
GW2
D2.2

FIG. 1

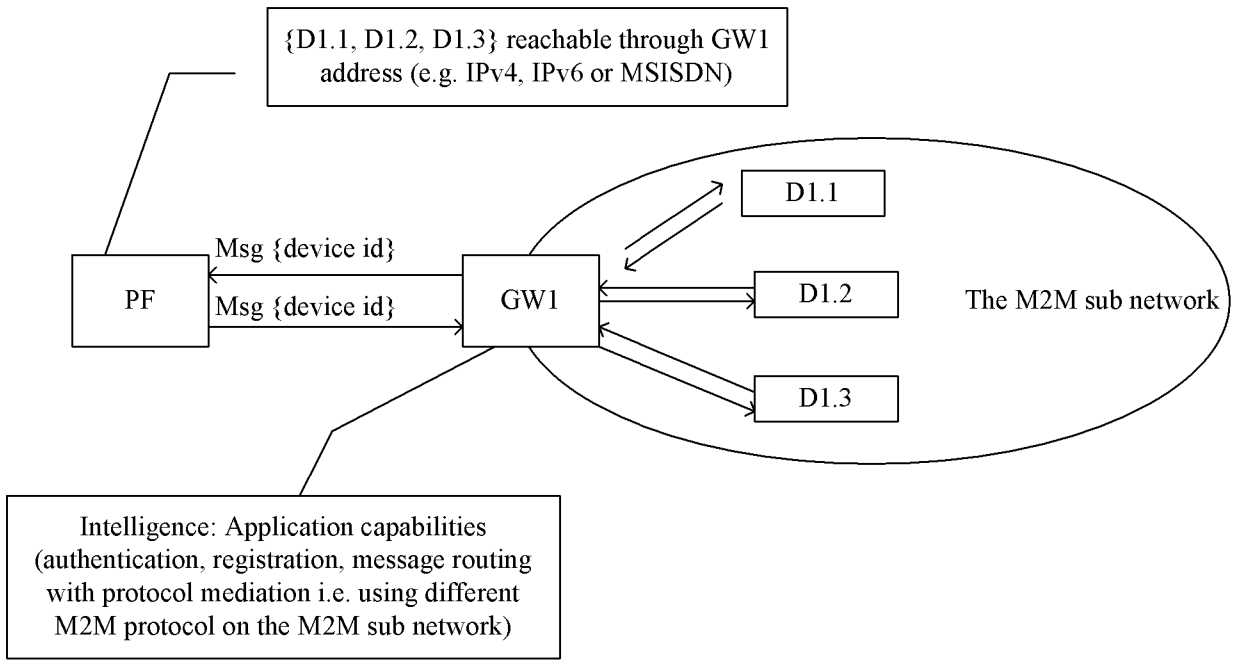
{D1.1, D1.2, D1.3} reachable through GW1 address (e.g. IPv4, IPv6 or MSISDN)
D1.1
Msg {device id}
PF
Msg {device id}
GW1
D1.2
The M2M sub network
D1.3
Intelligence: Application capabilities (authentication, registration, message routing with protocol mediation i.e. using different M2M protocol on the M2M sub network)

FIG. 2

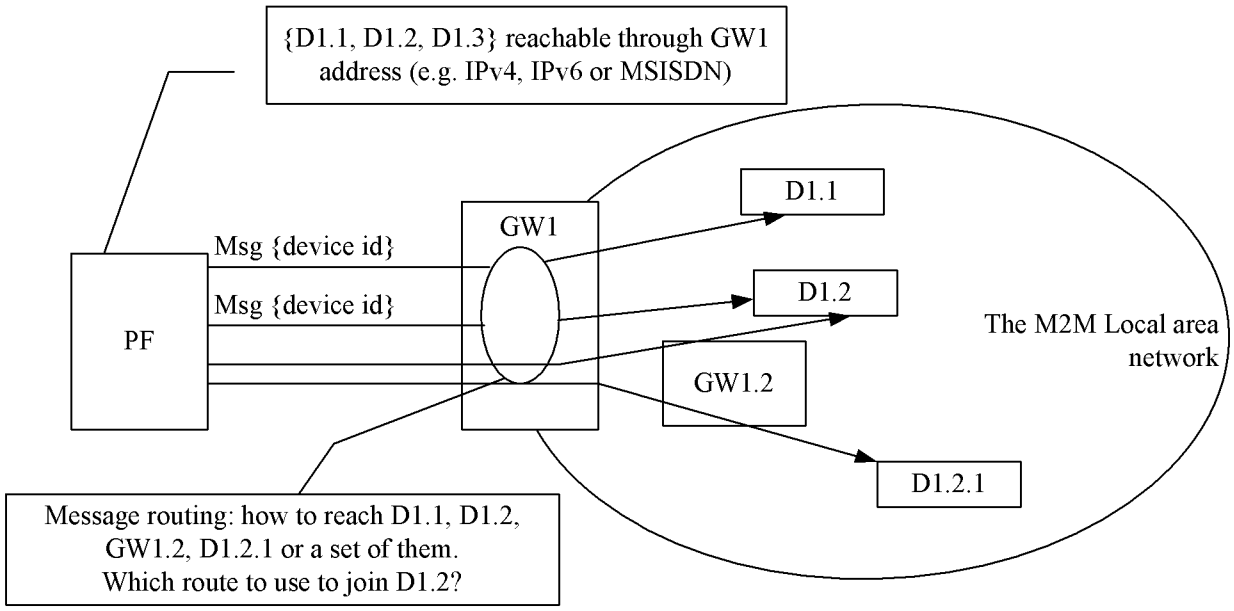
{D1.1, D1.2, D1.3} reachable through GW1
address (e.g. IPv4, IPv6 or MSISDN)
D1.1
GW1
Msg {device id}
D1.2
Msg {device id}
PF
The M2M Local area
network
GW1.2
D1.2.1
Message routing: how to reach D1.1, D1.2,
GW1.2, D1.2.1 or a set of them.
Which route to use to join D1.2?

FIG. 3

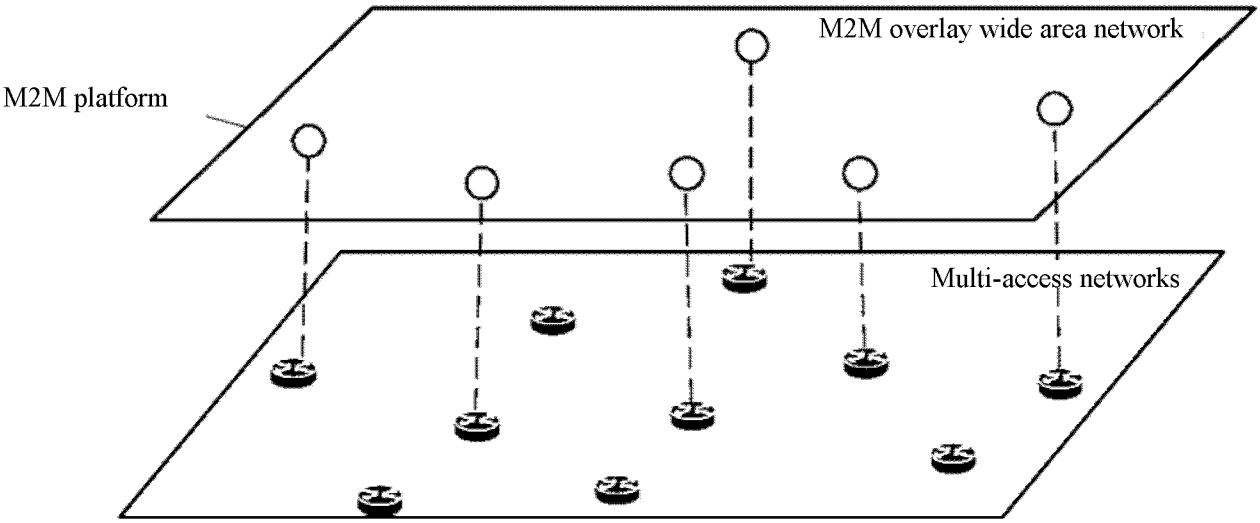
M2M overlay wide area network
M2M platform
Multi-access networks

FIG. 4

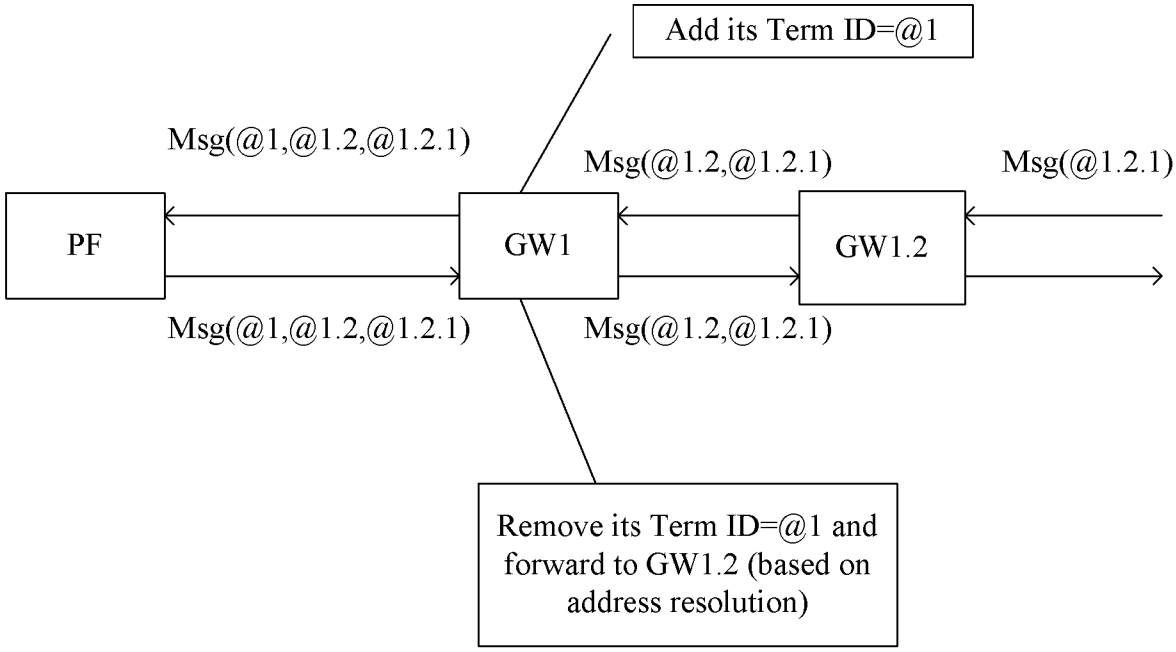

FIG. 5

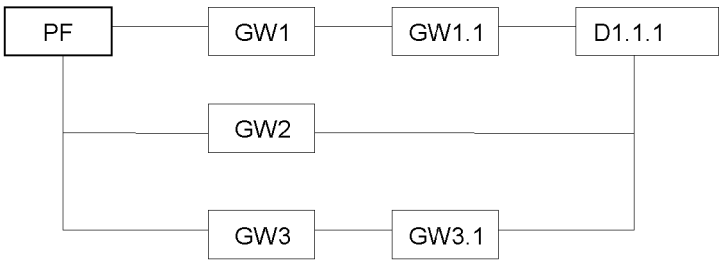

FIG. 6

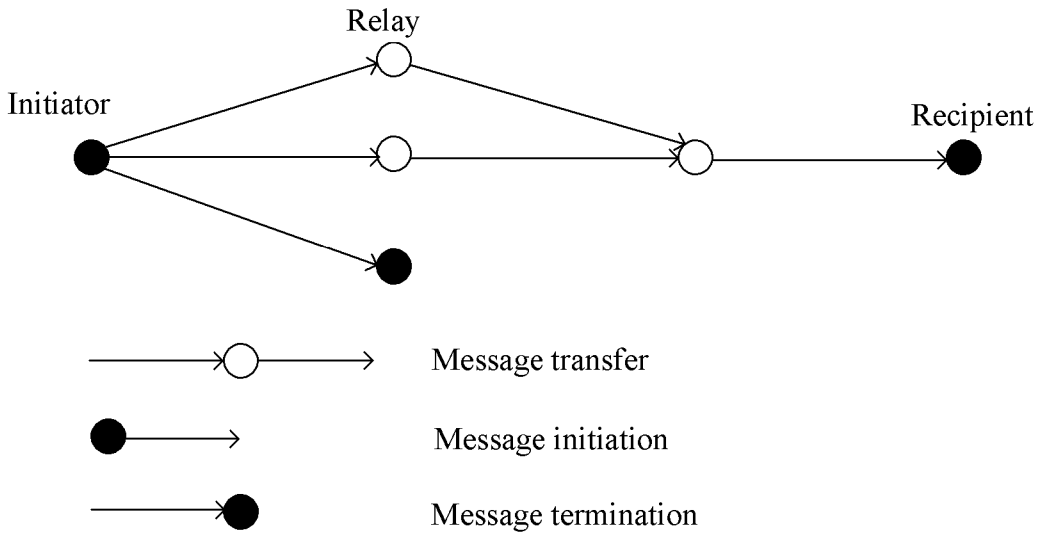

FIG. 7

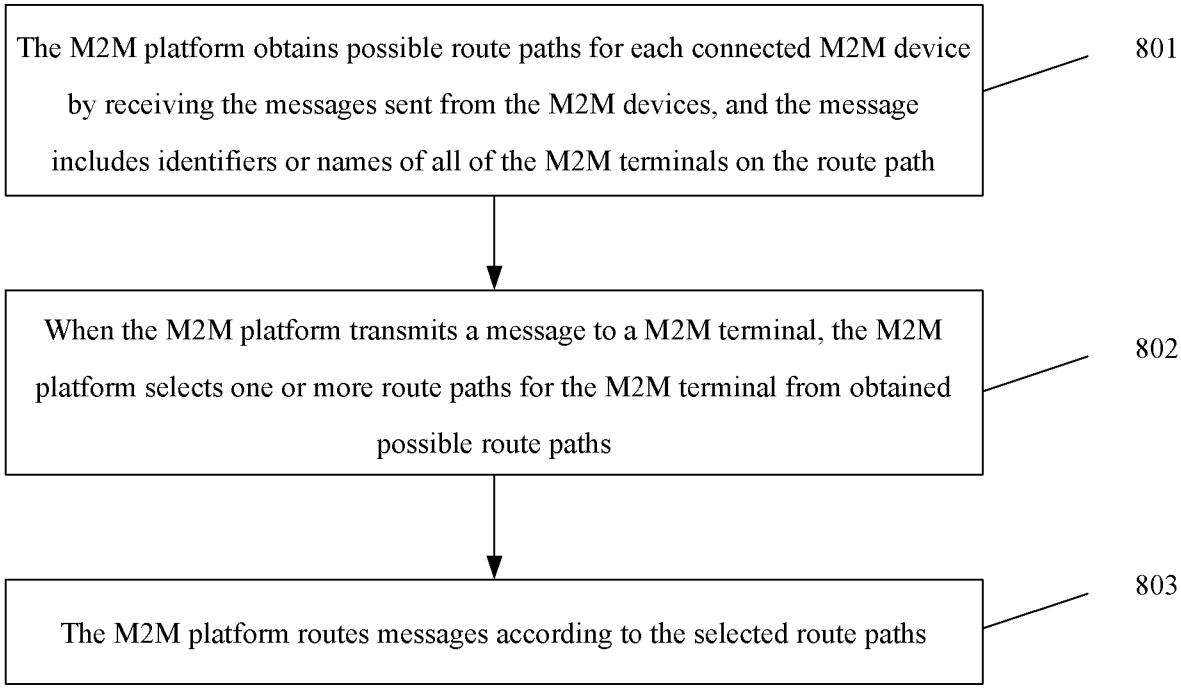
The M2M platform obtains possible route paths for each connected M2M device by receiving the messages sent from the M2M devices, and the message includes identifiers or names of all of the M2M terminals on the route path
801
When the M2M platform transmits a message to a M2M terminal, the M2M platform selects one or more route paths for the M2M terminal from obtained possible route paths
802
The M2M platform routes messages according to the selected route paths
803

FIG. 8

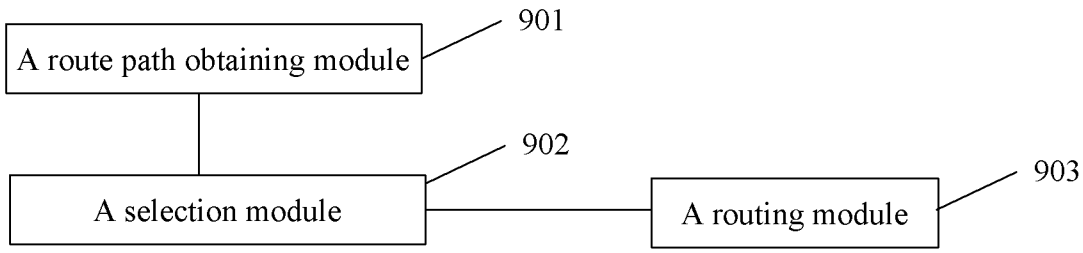
A route path obtaining module
901
A selection module
902
A routing module
903

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/072552

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/66 (2006.01)i

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: H04L, H04W

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 practicable, search terms used)

CNABS, VEN,CNKI, CNTXT: addressing, gateway, route, path, identifier, store, record, node, message,…

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN101577964A (ZTE CORP) 11 Nov. 2009 (11.11.2009) description page4 line6-page5 line23, abstract	1-2,5,10-11,13
A		3-4,6-9,12,14-15
A	CN101656631A (ZTE CORP) 24 Feb. 2010 (24.02.2010) the whole document	1-15
A	CN101543013A (SKYPE LTD) 23 Sep. 2009 (23.09.2009) the whole document	1-15
A	CN1091570A (IBM CORP) 31 Aug. 1994 (31.08.1994) the whole document	1-15

☐ Further documents are listed in the continuation of Box C. ☒ 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 application or patent 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
06 Jan. 2012 (06.01.2012)	**19 Jan. 2012 (19.01.2012)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer CHEN, Xi Telephone No. (86-10)62411514

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2011/072552

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN101577964A	11.11.2009	NONE	
CN101656631A	24.02.2010	NONE	
CN101543013A	23.09.2009	EP2090057A2	19.08.2009
		GB2445065B	22.06.2011
		GB2445065A	25.06.2008
		US2008192734A1	14.08.2008
		WO2008065533A2	05.06.2008
		WO2008065533A3	28.08.2008
CN1091570A	31.08.1994	BR9304798A	31.05.1994
		CN1052358C	10.05.2000
		DE69228423D1	25.03.1999
		ES2129038T3	01.06.1999
		EP0598969A1	01.06.1994
		EP0598969B1	10.02.1999
		CA2105040A1	28.05.1994
		TW265497A	11.12.1995
		CA2105040C	21.04.1998
		KR960014987B1	23.10.1996
		JP6224912A	12.08.1994
		US5361256A	01.11.1994