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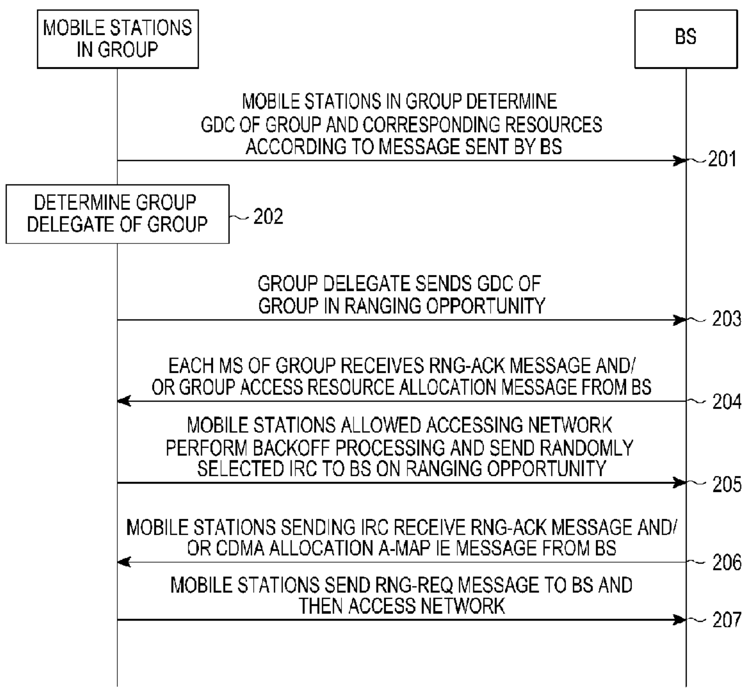
(54) Title: NETWORK REENTRY METHOD AND APPARATUS IN A MOBILE COMMUNICATION SYSTEM

[Fig. 2]



(57) Abstract: Provided is a network reentrymethod and apparatus in a mobile communication system. The network reentry method includes sending, by a group delegate Mobile Station (MS) among MSs of a group, a ranging code based on a group Identifier (ID) to a Base Station (BS) and receiving, by the MSs, a Ranging-Response (RNG-RSP) message comprising a ranging status for the group from the BS.

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Description

Title of Invention: NETWORK REENTRY METHOD AND APPARATUS IN A MOBILE COMMUNICATION SYSTEM

Technical Field

[1] The present invention relates to mobile communication systems, and more particularly, to a network reentry method and apparatus in a mobile communication system.

Background Art

[2] A Mobile Station (MS) usually operates according to a method shown in FIGURE 1 to access a network. Herein, the access to the network may include reentry to the network.

[3] FIGURE 1 is a diagram illustrating an operation between an MS and a Base Station (BS) in order for the MS to access the network in a conventional mobile communication system.

[4] Referring to FIGURE 1, in step 101, the MS performs downlink synchronization. In step 102, the MS obtains system information from the BS. The system information generally includes access codes and access opportunity information.

[5] In step 103, the MS accesses the network after performing backoff processing.

[6] In step 104, the MS sends an Initial Reference Code (IRC) to a Base Station (BS) included in a ranging opportunity. In this step, when the MS has no available ranging opportunity, e.g., when the access operation has expired or the number of access operations exceeds a threshold, step 104 is continued or the access operation is terminated, the factors of which may be determined according to practical applications.

[7] In step 105, the MS receives a Ranging-Acknowledgement (RNG-ACK) message or an Advanced Air Interface_Ranging-Acknowledgement (AAI_RNG-ACK) message from the BS, where the RNG-ACK message includes a response of the BS to the detected IRC.

[8] In step 106, the BS sends a Code Division Multiple Access (CDMA) Allocation A-MAP Information Element (IE) message to the MS to allocate Ranging-Request (RNG-REQ) resources to the MS.

[9] In step 107, the MS sends a RNG-REQ message to the BS after receiving the CDMA Allocation A-MAP IE message to inform the BS of information containing an Identifier (ID) of the MS, and then continues accessing the network.

[10] In step 108, the BS sends a Ranging-Response (RNG-RSP) message to the MS and allocates a temporary Station Identifier (STID) to the MS.

[11] In step 109, after the MS receives the RNG-RSP message, the BS and the MS

perform capability negotiation, the MS sends a Registration-Request (REG-REQ) message to the BS, and then the BS sends a Registration-Response (REG-RSP) message that includes the STID to the MS.

[12] Thus, through steps 101 through 109, the operation in which the MS accesses the network is completed.

[13] Further, the MS may operate in the following order to access the network.

[14] First, the MS obtains system information. Second, the MS sends an IRC to the BS in a ranging opportunity.

[15] Again, the MS listens to and receives a RNG-ACK message or a CDMA Allocation A-MAP IE message from the BS, where the RNG-ACK message or the CDMA Allocation A-MAP IE message includes a response of the BS to the detected IRC. In this step, according to receiving instances, the MS may obtain the system information or terminate the access operation because of various factors, which may be determined according to practical applications. For example, the access operation may be terminated when the MS does not receive the response to the IRC sent by the MS and does not have an available ranging opportunity, e.g., when the access operation has expired, the number of access operations exceeds a threshold or, when the response received by the MS indicates "abort". According to receiving instances, the MS may send the IRC to the BS, for example, when the MS does not receive the response to the IRC sent by the MS and has an available ranging opportunity, or when the response received by the MS indicates "continue". When the response indicates "abort", the BS may configure a timer for the MS, and when the timer has timed out, the MS may access the network again.

[16] When sending the IRC to the BS, the MS randomly selects the ranging opportunity and the IRC according to a backoff window.

[17] Finally, the MS continues accessing the network after the MS receives the RNG-ACK message indicating "success" and/or the CDMA Allocation A-MAP IE message, and sends a RNG-REQ message to the BS to inform the BS of information containing an ID of the MS.

[18] As can be seen from the above description, the conventional procedure that the MS accesses the network may be applicable to a single MS. In addition, the conventional MS obtains the IRC first when accessing the network, the IRC is selected randomly when the MS accesses the network, and the number of available IRCs is finite. Therefore, the conventional network access method for the MS may result in a conflict, such as when two or more MSs inadvertently select the same IRC, the MSs sending the same IRC may not all access the network successfully or all the MSs sending the same IRC may not access the network successfully. Especially, with the development of Machine to Machine (M2M) technology, more MSs may access the network at the

same time, which increases the possibility of conflict, and thus result in that some MSs cannot access the network successfully.

Disclosure of Invention

Technical Problem

[19] To address the above-discussed deficiencies of the prior art, it is a primary object to provide a network access method and apparatus which allows a plurality of MSs to access a network in a mobile communication system.

Solution to Problem

[20] According to an aspect of the present invention, there is provided a network reentry method in a mobile communication system, the method including sending, by a group delegate Mobile Station (MS) among MSs of a group, a ranging code based on a group Identifier (ID) to a Base Station (BS) and receiving, by the MSs, a Ranging-Response (RNG-RSP) message comprising a ranging status for the group from the BS.

[21] According to another aspect of the present invention, there is provided a network reentry method at a Base Station (BS) in a mobile communication system, the method including allocating a dedicated ranging code to a group delegate Mobile Station (MS) among MSs of a group, receiving a ranging code based on a group Identifier (ID) generated according to the dedicated ranging code from the group delegate MS, and sending a Ranging-Response (RNG-RSP) message comprising a ranging status for the group to the MSs.

[22] According to another aspect of the present invention, there is provided a network reentry apparatus in a mobile communication system, the apparatus including a controller by which a group delegate Mobile Station (MS) among MSs of a group determines a ranging code based on a group Identifier (ID), a sender by which the group delegate MS sends the ranging code based on the group ID to a Base Station (BS), and a receiver by which the MSs receive a Ranging-Response (RNG-RSP) message comprising a ranging status for the group from the BS.

[23] [004] According to another aspect of the present invention, there is provided a network reentry apparatus at a Base Station (BS) in a mobile communication system, the apparatus including a controller for allocating a dedicated ranging code to a group delegate Mobile Station (MS) among MSs of a group, a receiver for receiving a ranging code based on a group Identifier (ID) generated according to the dedicated ranging code from the group delegate MS, and a sender for sending a Ranging-Response (RNG-RSP) message comprising a ranging status for the group to the MSs.

Brief Description of Drawings

[24] For a more complete understanding of the present disclosure and its advantages, reference is now made to the following description taken in conjunction with the ac-

companying drawings, in which like reference numerals represent like parts:

[25] FIGURE 1 illustrates an example operation between an MS and a BS in order for the MS to access the network in a conventional mobile communication system;

[26] FIGURE 2 illustrates an example operation between an MS and a BS in order for the MS to access the network in a mobile communication system according to a first embodiment of the present invention;

[27] FIGURE 3 illustrates an example operation between an MS and a BS in order for the MS to access the network in a mobile communication system according to a second embodiment of the present invention; and

[28] FIGURE 4 illustrates an example method for selecting a group delegate through communication between an MS and a BS according to one or more embodiments of the present invention.

Mode for the Invention

[29] FIGURES 2 through 4, discussed below, and the various embodiments used to describe the principles of the present disclosure in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the disclosure. Those skilled in the art will understand that the principles of the present disclosure may be implemented in any suitably arranged communication networks. Hereinafter, exemplary embodiments of the present invention will be described in more detail with reference to the accompanying drawings. Herein, only necessary parts for understanding of operations according to the present invention will be described, and other parts will not be described not to obscure the subject matter of the present invention.

[30] Before describing specific embodiments, concepts of group, group delegate and group member will be described.

[31] The group includes an entity composed of MSs that have one or more common attributes, where the one or more common attributes may be the same or similar service, the same or similar reporting period, belonging to the same subscriber, adjacent geography location, and so on.

[32] The group delegate is a certain MS which can represent all or particular part of MSs in the group to execute a specific function. There may alternativelybe one or more group delegates in one group, and the group delegate may be any one MS in the group.

[33] The group members are the MSs other than the group delegate in the group.

[34] It should be described that, when the embodiments of the present invention are to be implemented, the MSs may be delegated into groups in advance according to one or more common attributes, which can be performed according to a conventional mode.

[35] It should also be noted that, in order to decrease the number of MSs accessing the

network overa period of time, the period of time in which the MSs access the network may be delineated into time segments, so that a finite number of MSs may access the network in a certain time segment, for decreasing potential conflict.

[36] In order for the MS to access the network in a mobile communication system, the following operations are performed between the MS and the BSaccording to certain embodiments of the present invention. Herein, operations will be described in which the MSs are initially delegated in groups and a group delegate for each group is selected. A method for selecting the group delegate will be described in detail for each embodiment.

[37] In a first embodiment of the present invention, a MS first learns of its own group accordingto a message sent by the BS or according to a preconfiguration mode. The MSs in each group determine a GDC of the group according to the message sent by the BS. The group delegate sends the Group Delegate Code (GDC)allocated to the group to the BS in aranging opportunity. Each MS in the group receives a RNG-ACK message and/or a group access resource allocation message from the BS. After receiving backoff information broadcasted by the BS and performing backoff processing, a MS receiving a message of allowing accessing the network in the group sends a randomly selected IRC to the BS on the ranging opportunity.

[38] The MS sending the IRC receives the RNG-ACK message and/or a CDMA Allocation A-MAP IE message from the BS, where the RNG-ACK message and/or the CDMA Allocation A-MAP IE message includes a response to the MS sending the IRC. After receiving the RNG-ACK message and/or the CDMA Allocation A-MAP IE message, the MS sends a RNG-REQ message to the BS and thereafter accesses the network.

[39] In a second embodiment, a MS learns its own group according to a message sent by the BS or according to a preconfiguration mode. The MSs in each group determine a GDC of the group according to the message sent by the BS. The group delegate sends the GDC to the BS in a ranging opportunity. Each MS in the group receives a RNG-ACK message from the BS. An MS receiving a message of allowing access to the network in the group sends a pre-allocated IRC to the BS on the ranging opportunity.

[40] The MS sending the IRC receives the RNG-ACK message and/or a CDMA Allocation A-MAP IE message from the BS, where the RNG-ACK message and/or the CDMA Allocation A-MAP IE message includesa response to the MS sending the IRC. After receiving the RNG-ACK message and/or the CDMA Allocation A-MAP IE message, the MS sends a RNG-REQ message to the BS and thereafter accesses the network.

[41] In order to make the object(s), technical solution(s) and merits of the present invention clearer, the first and second embodiments of the present invention will be

described in detail hereinafter with reference to FIGURES 2 and 3.

[42] FIGURE 2 illustrates an example operation between an MS and a BS for the MS to access the network in a mobile communication system. Although not shown in the drawings, each of the MS and the BS includes at least a sender, a receiver, and a controller, and the sender and the receiver transmit and receive messages, and the controller of the MS and the BS controls the operations according to the first embodiment of the present invention.

[43] Referring to step 201, MSs in a group determine a GDC of the group and corresponding resources according to a message sent by a BS. It should be described that the GDC may also be called as a Group Access Code, or a Group Initial Reference Code (GIRC) or a ranging code. The GDC may include one or more codes. The GDC may be a code in a conventional IRC, or a code reallocated to the MSs by the system.

[44] Each group may correspond to an initial GDC, and the initial GDC based on the group ID can be obtained according to a following formula:

[45] $C_{M2M\ group\ RP}$=mod ($ID_{M2M\ Group}$, $N_{M2M\ group}$) ··· ·······(1),

[46] wherein $ID_{M2M\ Group}$ is a group ID, $N_{M2M\ group}$ is the number of GDCs, and mod() represents obtaining modulus.

[47] If one frame includes multiple random access opportunities, each group selects a random access opportunity according to a following formula:

[48] $Idx_{Ranging\ opp}$=mod (floor ($ID_{M2M\ Group}$, $N_{M2M\ group}$), N_{Opp}··· (2),

[49] wherein N_{Opp} is the number of random access opportunities, and floor() represents taking an integer not larger than the number of random access opportunities.

[50] The GDCs of group and M2M additional initial ranging codes should be orthogonal with GDCs because these ranging codes are transmitted on a random access opportunity and need to be fully utilized. To this end, a code dynamic partitioning method may be adopted. By the code dynamic partitioning method, the orthogonal intersection between two kinds of codes may be guaranteed, code resources can be fully utilized, and the BS may identify access motives of different MSs according to different kinds of codes. Specifically, there are two code dynamic partitioning methods:

[51] 1. If a Zadoff-Chu sequence with a cyclic shift function is used for generating the GDC, the Zadoff-Chu sequence may be defined as:

[52] $Xp(k)=\exp(-j\cdot \Pi \cdot(r_p\cdot k(k+1)+2\cdot k\cdot s_p\cdot N_{CS})/N_{RP})$········ (3),

[53] where k=0,1,...,N_{RP}-1, where pis a sequence number of the GDC. r_p may be defined as:

[54] $$r_p = \mathrm{mod}\left(\left(1-2\cdot \mathrm{mod}\left(\left\lfloor \frac{p}{M_{ns}}\right\rfloor, 2\right)\right)\cdot\left(\left\lfloor \frac{\frac{p}{M_{ns}}}{2}\right\rfloor + r_{ns0}\right) + N_{RP}, N_{RP}\right) \quad \cdots \cdots (4),$$

[55] wherein $p=0,1,2...N_{cont-1}, N_{cont}+N_{dedi},..., N_{cont}+N_{dedi}+N_{M2M\ group}+N_{M2M\ Add}-1$, $s_p=mod(p,M_{ns})$. r_{ns0} is broadcasted in a Secondary-Super Frame Header (S-SFH), M_{ns} is the times of cyclic shift of the Zadoff-Chu sequence's root, $N_{cont}$is a sum of initial ranging codes N_{IN} for general random access and handover ranging codes N_{HO}, N_{dedi} is dedicated ranging codes, $N_{M2M\ group}$ is GDCs, N_{M2M} Add is newly-added initial ranging codes for an M2M application. There is no intersection between two kinds of codes. Specifically, N_{cont} is a sum of the number (0~$N_{IN}-1$) of initial ranging codes N_{IN} for general random access in each sector and the number (N_{IN}~$N_{IN}+N_{HO}-1$) of handover ranging codes, Ndedi is dedicated Ranging codes, which is represented with (N_{cont}~ $N_{cont}+N_{dedi}-1$) and includes 32 dedicated ranging codes at most, $N_{M2M\ group}$ is GDCs allocated to the M2M group by each sector, which is represented with ($N_{cont}+ N_{dedi}$ ~ $N_{cont}+ N_{dedi}+ N_{M2M\ group}-1$) and includes a maximum of 32 GDCs, and NM2M add is newly-added initial ranging codes for an M2M application, which is represented with (N_{cont}+ Ndedi+ $N_{M2M\ group}$ ~ $N_{cont}+ N_{dedi} + N_{M2M\ group}+ N_{M2M\ add} -1$) and includes a maximum of 32 additional ranging codes. The M2M MS may randomly select ranging codes from the initial ranging codes N_{IN} for general random access and $N_{M2M\ add}$ to perform initial access. N_{CS} is a unit of cyclic shift, and N_{RP} is the length of ranging codes.

[56] The foregoing is only an example, the allocation of ranging codes may be performed in a sequence, but the sequence of allocating the GDCs of the M2M group and allocating the M2M additional codes may beunimportant, the M2M additional codes may be allocated initially, and then the GDCs of the M2M group may be allocated. Table 1 shows how GDCs are allocated of the M2M group and the M2M additional codes, and how a subset or deduction of this table may be used in practical applications.

[57] Table 1

[58]

Partition Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Number of the M2M Group codes, $N_{M2M\ Group}$	0	0	0	0	0	0	0	8	8	8	8	8	8	8	8	8	16	16	16	16	16	16
Number of the M2M additional code $N_{M2M\ Add}$	8	16	32	40	48	56	64	0	8	16	24	32	40	48	56	64	0	8	16	24	32	40

[59]

Partition Index	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Number of the M2M Group codes, $N_{M2M\ Group}$	16	24	24	24	24	24	24	32	32	32	32	32	40	40	40	40	48	48	48
Number of the M2M additional code $N_{M2M\ Add}$	48	0	8	16	24	32	40	0	8	16	24	32	0	8	16	24	0	8	16

[60]

Partition Index	22	23	24
Number of the M2M Group codes, $N_{M2M\ Group}$	56	56	64
Number of the M2M additional code $N_{M2M\ Add}$	0	8	0

[61] Since the dedicated ranging codes and the regular codes are transmitted on different ranging resources, the allocation of the dedicated ranging codes may not be considered, but only the initial ranging codes N_{IN} for general random access and the handover ranging codes N_{HO} are considered. $N_{M2M\ group}$ is GDCs allocated to the M2M group by each sector, which is represented with (N_{cont} ~ N_{cont} + $N_{M2M\ group}$-1), and $N_{M2M\ add}$ is newly-added ranging codes for an M2M application, which is represented with (N_{cont} + $N_{M2M\ group}$~ N_{cont} +$N_{M2M\ group}$ + $N_{M2M\ add}$ -1). If the handover ranging codes are not considered, other codes except regular initial access ranging codes are all allocated to M2M group GDCs and M2M additional codes. NM2M group may be represented with (N_{IN} ~ N_{IN} + $N_{M2M\ group}$-1), and N_{M2M} add may be represented with (N_{IN} + $N_{M2M\ group}$~ N_{IN} +$N_{M2M\ group}$ + $N_{M2M\ add}$ -1).

[62] Table 2 shows a schematic code allocation table. The number of initial ranging codes N_{IN} for general random access is represented with (0~N_{IN}-1), and the number of

handover ranging codes is represented with (N_{IN}~N_{IN}+N_{HO}-1). N_{M2M} add is newly-added initial codes for an M2M application, which is represented with (N_{IN}+N_{HO} ~ N_{IN} +N_{HO}+ $N_{M2M\ add}$ -1) and includes a maximum of 32 additional ranging codes, N_{M2M} groupis GDCs allocated to the M2M group by each sector, which is represented with (N_{IN}+N_{HO} + $N_{M2M\ add}$ ~ N_{IN}+N_{HO}+ $N_{M2M\ add}$ + $N_{M2M\ group}$-1) and includes a maximum of 32 GDCs. 16 types of configuration may be represented with 4 bits of information, and thus, the allocation of different kinds of codes shown in Table 2 may be obtained using 4 bits of a superframe header. If the number of redundant codes is finite, such as 32 codes, the GDCs and the newly-added initial ranging codes for an M2M application may share the codes. The specific allocation refers to a code allocation table shown in Table 3. For a case that the number of codes is finite, the GDCs and the newly-added initial ranging codes for an M2M application mayshare the codes, but the sharing proportion is not limited to Table 3.

[63] Table 2

[64]

Partition Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of the initial RP codes, N_{IN}	8	8	8	8	16	16	16	16	24	24	24	24	32	32	32	32
Number of the handover RP codes, N_{HO}	8	16	24	32	8	16	24	32	8	16	24	32	8	16	24	32
Number of the M2M additional codes $N_{M2M\ Add}$	8	16	24	32	8	16	24	32	8	16	24	32	8	16	24	32
Number of the M2M Group codes, $N_{M2M\ Group}$	8	8	8	8	16	16	16	16	24	24	24	24	32	32	32	32

[65] Table 3

[66]

Partition Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of the initial RP codes, N_{IK}	8	8	8	8	16	16	16	16	24	24	24	24	32	32	32	32
Number of the handover RP codes, N_{HO}	8	16	24	32	8	16	24	32	8	16	24	32	8	16	24	32
Number of the M2M additional code $N_{M2M\ Add}$	8	16	24	32	8	16	24	32	8	16	24	32	8	16	24	32
Number of the M2M Group codes, $N_{M2M\ Group}$	24	16	8	0	24	16	8	0	24	16	8	0	24	16	8	0

[67] 2. If a ranging opportunity is allocated to a synchronized AMS, the initial ranging codes may be extended, and Zadoff-Chu sequences with filling and cyclic shift functions may be taken as the ranging codes, which are represented by:

[68] $$Xp(n,k)-exp((-j\cdot \prod (rp\cdot(n\cdot71+k)\cdot(n\cdot71+k+1))/211+2\cdot k\cdot sp\cdot Nrcs/NFFT)), \cdots\cdots \cdots\cdots\cdots (5),$$

[69] wherein K=0,1,…,N_{RP}-1;n=0,1,2, where p is a sequence number of the ranging code. r_p may be defined as:

[70] $$r_p = \mathrm{mod}\left(\left(1 - 2\cdot \mathrm{mod}\left(\left\lfloor \frac{p}{M_s} \right\rfloor, 2\right)\right)\cdot\left(\left\lfloor \frac{\frac{p}{M_{ns}}}{2} \right\rfloor + r_{ns0}\right) + 211, 211\right) \cdots\cdots (6),$$

[71] wherein p=0,1,2...N_{cont}-1,N_{cont}+N_{dedi},..., N_{cont}+N_{dedi}+$N_{M2M\ group}$+$N_{M2M\ Add}$-1, and sp=mod(p,Ms).

[72] For a home BS, Ncont represents ranging codes for general initial access, the sum Ndedi of the handover codes and periodic ranging codes are dedicated ranging codes, $N_{M2M\ group}$ is GDCs allocated to the M2M group, and $N_{M2M\ Add}$ is additional codes for an M2M application. There is no intersection between two kinds of codes. N_{cont} is a sum of the number (0~N_{IN}-1)of ranging codes for general initial access in each sector, the number (N_{IN}~N_{IN}+N_{HO}-1)of handover ranging codes and the number (N_{IN} + N_{HO}~N_{IN} + N_{HO} + N_{PE} - 1)of periodic ranging codes. Ndedi is dedicated ranging codes, which is represented with (N_{cont}~ N_{cont}+N_{dedi}-1) and includes a maximum of 32 ranging codes, $N_{M2M\ add}$ is newly-added codes for an M2M application, which is represented with (N_{cont} +N_{dedi}~ N_{cont}+ N_{dedi} + $N_{M2M\ add}$ -1) and includes a maximum of 32 ranging codes. N_{M2M}

$_{group}$ is codes allocated to the M2M group by each sector, which is represented with ($N_{cont}+N_{dedi}+N_{M2M\ add}$ ~ $N_{cont}+N_{dedi}++ N_{M2M\ add}+ N_{M2M\ group}-1$) and includes a maximum of 32 ranging codes. The M2M MS may randomly select GDC ranging codes from N_{IN} and $N_{M2M\ add}$ to perform initial access. Since the dedicated ranging codes and the regular codes are transmitted on differentranging resources, the allocation of the dedicated ranging codes may not be considered, while only the initial ranging codes N_{IN} for general random access, the handover ranging codes N_{HO} and the periodic ranging codes are considered. $N_{M2M\ add}$ is newly-added codes for an M2M application, which is represented with (N_{cont} ~ $N_{cont} + N_{M2M\ add}$ -1) and includes a maximum of 32 ranging codes. NM2M group is codes allocated to the M2M group by each sector, which is represented with ($N_{cont} +N_{M2M\ add}$ ~ $N_{cont} + N_{M2M\ add} + N_{M2M\ group}-1$) and includes a maximum of 32 ranging codes. Table 4 shows an example code allocation table, which is a subset or deduction of this table may be used in practical applications. The foregoing is only an example, the allocation of ranging codes may be performed in a sequence, but the sequence of allocating the GDCs of the M2M group and allocating the M2M addition codes is unimportant, the M2M addition codes may be allocated initially, and then the GDCs of the M2M group may be allocated.

[73] Table 4

[74]

Partition Index	Number of the initial RP codes, *NIN*	Number of the handover RP codes, NHO	Number of the periodic RP codes, *NPE*	Number of M2M Add $N_{M2M\ Add}$	Number of M2M Group $N_{M2M\ group}$
0	4	4	4	4	4
1	4	8	4	8	4
2	4	16	4	16	4
3	4	24	4	24	4
4	8	4	8	4	8
5	8	8	8	8	8
6	8	16	8	16	8
7	8	24	8	24	8

[75]

8	16	4	16	4	16
9	16	8	16	8	16
10	16	16	16	16	16
11	16	24	16	24	16
12	24	4	24	4	24
13	24	8	24	8	24
14	24	16	24	16	24
15	24	24	16	24	24

[76] For a case that a ranging GDC opportunity multiplexes Frequency Division Multiplex (FDM) resources in a wireless Metropolitan Area Network Orthogonal Frequency Division Multiple Access (MAN-OFDMA) system and an advanced wireless MAN-OFDMA system, the number of ranging GDCs may be256, each BS uses one group of ranging GDCs, and the initial number of the ranging GDCs in this group is rns0, a sequence which can be used by the BS is between rns0 and ((N_{IN} + N_{HO} + N_{PE} + N_{dedi} + $N_{M2M\ group}$ + $N_{M2M\ add}$) mod 256). NIN is initial ranging GDCs, NHO is initial handover ranging GDCs, NPEis periodic ranging GDCs, N_{dedi} is dedicated ranging GDCs, $N_{M2M\ group}$ is group ranging GDCs, and $N_{M2M\ add}$ is M2M additional ranging GDCs.

[77] The number of codes contained in the $N_{M2M\ add}$ is a maximum of 32, and the $N_{M2M\ add}$ is obtained through shifting from 144 × ((rns0 + NIN +NHO+NPE+ Ndedi) mod 256) to 144 × ((rns0 + N_{IN} + N_{HO} + N_{PE} + N_{dedi} + $N_{M2M\ add}$) mod 256) 1 by a Pseudo Random Binary Sequence (PRBS) generator.

[78] The number of codes includedin the $N_{M2M\ group}$ is a maximum of 32, and the $N_{M2M\ group}$ is obtained through shifting from 144 × ((rns0 + N_{IN} +N_{HO} + N_{PE} + N_{dedi} + $N_{M2M\ add}$) mod 256) to 144 × ((rns0 + N_{IN} + N_{HO}+ N_{PE} + N_{dedi}+ $N_{M2M\ add}$ + $N_{M2M\ group}$) mod 256) 1 by the PRBS generator.

[79] Since the dedicated ranging codes and the regular codes occupy different resources, the allocation of the dedicated ranging codes may not be considered, but only the initial ranging codes, the handover ranging codes and periodic ranging codes are considered. The number of codes contained in the $N_{M2M\ add}$ is a maximum of 32, and is obtained through shifting from 144 × ((rns0 + N_{IN} + N_{dedi}) mod 256) to 144 × ((rns0 + N_{IN} + N_{dedi} + $N_{M2M\ add}$) mod 256) 1 by the PRBS generator. The number of codes contained in the $N_{M2M\ group}$ is a maximum of 32 codes, and is obtained through shifting from 144 × ((rns0 + N_{IN} + N_{dedi}+ $N_{M2M\ add}$) mod 256) to 144 × ((rns0 + N_{IN} + N_{dedi} + $N_{M2M\ add}$ +$N_{M2M\ group}$) mod 256) 1 by the PRBS generator. The NM2M group is codes allocated to the M2M group by each sector, which can be obtained through shifting from 144 × ((rns0 + N_{IN} + N_{HO} + N_{PE}) mod 256) to 144 ×((rns0 + N_{IN} + N_{HO} + N_{PE} + N

$_{M2M\ group}$) mod 256) 1 by the PRBS generator.

[80] If thehandover codes and periodic codes are not considered, other codes except regular initial ranging codes are all allocated to the M2M group and the additional codes, the NM2M add may be obtained through shifting from 144 × ((rns0 + N_{IN}) mod 256) to 144 × ((rns0 + N_{IN} + $N_{M2M\ add}$) mod 256) 1 by the PRBS generator, and the $N_{M2M\ group}$ may be obtained through shifting from 144 × ((rns0 + N_{IN} +$N_{M2M\ add}$) mod 256) to 144 × ((rns0 + N_{IN} + $N_{M2M\ group}$ + $N_{M2M\ add}$) mod 256) 1 by the PRBS generator. Table 5 shows the allocation of the NM2M group and the $N_{M2M\ Add}$.

[81] Table 5

[82]

Partition Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of the M2M Group codes, NM2M Group	8	8	8	8	16	16	16	16	24	24	24	24	32	32	32	32
Number of the M2M additional code NM2M Add	8	16	24	32	8	16	24	32	8	16	24	32	8	16	24	32

[83] Though codes for an M2M application are added, more ranging opportunities are used to increase access resources, so that more M2M MSs can access the network. Therefore, new random access opportunities are defined in the present invention. Since each superframe includes4 frames and the first and second frames are respectively allocated to the regular initial access opportunity and a synchronized access opportunity, the ranging resources of the third and fourth frames are taken as the M2M additional initial access opportunity in the present invention. The specific access opportunity allocation is shown in Table 6.

[84] Table 6 shows four allocation cases:

[85] Case1: Dedicated ranging channel for M2M is allocated/configured in every frame of one superframe.

[86] Case2: Dedicated ranging channel for M2M is allocated/configured in third frame of one superframe and does not conflict with normal/regular ranging opportunities.

[87] Case3: Dedicated ranging channel for M2M is allocated/configured in fourth frame of one superframe and does not conflict with normal/regular ranging opportunities.

[88] Case4. Dedicated ranging channel for M2M is allocated/configured in third and fourth frame of one superframe and does not conflict with normal/regular ranging opportunities. The M2M group GDCs and M2M additional codes may be transmitted in an original regular initial access opportunity, an additional initial access opportunity and a dynamic initial access opportunity.

[89] Table 6

[90]

Configurations	The AAI subframe allocating the NS-RCH
0	$(OSF+2)^{th}$ UL AAI subframe in every frame except the AAI subframe that has already been used for a regular allocation.
1	OSF^{th} UL AAI subframes in the third frame in every superframe except the AAI subframe that has already been used for a regular allocation.
2	OSF^{th} UL AAI subframe in the third frame in every even numbered superframe, i.e., mod(superframe number, 2) = 0 except the AAI subframe that has already been used for a regular allocation.
3	OSF^{th} UL AAI subframe of the third frame in every 4^{th} superframe, i.e. mod(superframe number, 4) = 0 except the AAI subframe that has already been used for a regular allocation.
4	OSF^{th} UL AAI subframes in the last frame in every superframe except the AAI subframe that has already been used for a regular allocation.
5	OSF^{th} UL AAI subframe in the last frame in every even numbered superframe, i.e., mod(superframe number, 2) = 0 except the AAI subframe that has already been used for a regular allocation.

[91]

[92]

6	OSF^{th} UL AAI subframe of the last frame in every 4^{th} superframe, i.e. mod(superframe number, 4) = 0 except the AAI subframe that has already been used for a regular allocation.
7	OSF^{th} UL AAI subframes in the third and last frame in every superframe except the AAI subframe that has already been used for a regular allocation.
8	OSF^{th} UL AAI subframe in the third and last frame in every even numbered superframe, i.e., mod(superframe number, 2) = 0 except the AAI subframe that has already been used for a regular allocation.

[93]

9	OSF^{th} UL AAI subframe of the third and last frame in every 4^{th} superframe, i.e. mod(superframe number, 4) = 0 except the AAI subframe that has already been used for a regular allocation.

[94] Table 7 shows theM2M group GDCs and the M2M additional ranging codes broadcasted in S-SFH SP1, while Table 8 shows the support that the BS responds to the received initial ranging codes including regular initial ranging codes and additional ranging codes sent by M2M with an ACK message in an AAI-RNG-ACK message. Table 9 shows the support that the BS responds to the M2M group GDCs with an ACK message in an AAI-RNG-ACK message.

[95] [002] Table 7

[96]

Syntax	Size (bit)	Description
...	...	...
Reserved		
Support of M2M devices	1	Indicates whether system supports M2M devices or not 0b0 : No support 0b1 : Support
If (Support of M2M devices)		Indicates support of the M2M devices, when Support of M2M devices is 0b1

[97]

The M2M Group and individual additional RP code partition information for the NS-RCH	4	Indicates the number of M2M Group and individual additional initial RP codes (NM2M group and NM2M add) according to the Table 1 or 2.
Allocation periodicity of the additional NS-RCH for M2M devices	4	Indicates the periodicity of the additional NS-RCH allocation for M2M devices according to the Table 5.

[98]

Start RP code information of the NS-RCH	4	Indicates the kns which is the parameter controlling the start root index of the RP codes (rns0). rns0(kns)=4xkns+1 for NS-RCH format 0. rns0(kns)=16xkns+1 for NS-RCH format 1. The range of values is 0≤kns≤15
Number of the cyclic shifted RP codes per root index for the NSRCH	2	Indicates the number of cyclic shifted codes per root index (Mns) for RP codes

[99]

Subframe offset of the additional NS-RCH for M2M devices	2	Indicates the subframe offset (OSF) of the NS-RCH allocation related to the Table 5 except the AAI subframe that has already been used for a regular allocation.
NS-RCH formats	1	Indicates the NS-RCH formats

[100] Table 8

[101]

Field	Size	(bits)	Description
...	...	...	...
For (j=0; j<N_Received_Codes; j++) {		The number of ranging preamble code indices (i.e.N_Received_Codes)[1..64] detected in this corresponding ranging opportunity.	N_Received_Codes should include additional M2M initial ranging codes if M2M additional initial ranging code is supported

[102]

Index Ranging preamble code	6	Index received in this ranging opportunity.	Index should indicate additional M2M initial ranging codes if M2M additional initial ranging code is supported

[103]

Ranging Status	2	Indicate whether ranging preamble code or UL burst is received within acceptable limits by ABS. 0b00 = success 0b01 = abort 0b10 = continue	
If (Ranging Status == 0b01) {			

[104]

Ranging Abort Timer	16	Timer defined by an ABS to prohibit the AMS from attempting network entry at this ABS, for a specific time duration. Value: 0 (Do not try ranging again at the ABS.) Value: 1-65535, In units of seconds	

[105]

}else if (Ranging Status ==0b10) {			
Adjustment parameters indication (API)	3	Bit#0: Time offset adjustment indication. Bit#1: Power level adjustment indication Bit#2: Frequency offset adjustment Indication	

[106]

If(API Bit#0==0b1) {			
Timing offset adjustment	15		
}			
If(API Bit#1==0b1) {			
Power level adjustment	4		
}			
If (API Bit#2==0b1) {			

[107]

Frequency offset adjustment	9		
}			
}			
}			
...	...	...	...

[108] Table 9

[109]

Field	Size (bits)	Value/Description	Condition
For (j=0; j<N_Received_Codes for M2M group; j++) {		The number of ranging preamble code indices(i.e. N_Received_Codes)[1..64] detected in this corresponding ranging opportunity.	

[110]

Ranging Status	2	Indicate whether ranging preamble code or UL burst is received within acceptable limits by ABS. 0b00 = success for M2M Group 0b01 = abort for M2M Group 0b10 = continue	
If (Ranging Status == 0b01) {			

[111]

Ranging Abort Timer	16	Timer defined by an ABS to prohibit the AMS from attempting network entry at this ABS, for a specific time duration. Value: 0 (Do not try ranging again at the ABS.) Value: 1-65535, In units of seconds	
}else if (Ranging Status ==0b10) {			

[112]

Adjustment parameters indication (API)	3	Bit#0: Time offset adjustment indication. Bit#1: Power level adjustment indication Bit#2: Frequency offset adjustment Indication	
If(API Bit#0==0b1) {			

[113]

Timing offset adjustment	15		
}			
If(API Bit#1==0b1) {			
Power level adjustment	4		
}			
If (API Bit#2==0b1) {			
Frequency offset adjustment	9		

[114]

}			
}			
}			...

[115] Referring back to FIGURE 2, in step 202, the MSs in the group selects a group delegate of the group according to the message sent by the BS.

[116] It should be described that, the group delegate may be selected, but is not limited to, by calculating a formula (mod (group member ID, k) or (mod (group member ID, f(k, frame number)), where k is a positive integer and may be determined by the BS, and f(k, frame number) is a function related to k and the frame number, i.e., the value of f(k, frame number) is related to both k and time. The group delegate may be pre-selected.

[117] It should be also noted that, the group delegate may be selected before step 201, and may be selected by the MS and the BS together as shown in FIGURE 4. Thus, there is signaling interaction between the BS and the MS when the group delegate is selected. There are three modes for selecting the group delegate, such as a preconfiguration mode, a random selection mode of the MS, and a cooperation method of the BS (selected by the network) and the MS.

[118] In step 203, the group delegate sends the GDC based on the group ID to the BS in a ranging opportunity.

[119] In step 203, the selection of the ranging opportunity in an example is implemented as follows: if a data frame only includesone ranging opportunity, the GDC is sent in the

ranging opportunity; if the data frame includes multiple ranging opportunities, one ranging opportunity is selected from the multiple ranging opportunities according to a formula mod (floor (ID M2M Group, NM2M group), NOpp).

[120] In step 204, each MS in the group receives a RNG-ACK message and/or a group access resource allocation message from the BS.

[121] It should be noted that, after receiving the GDC, the BS sends the RNG-ACK message and/or the group access resource allocation message to the MS, and the message includes three types of information. The first typeof information indicates identification and success, such as all or part of MSs in the group are allowed to access the network. The second type of information indicates that the GDC continues to be sent to correct timing, frequency offset and power adjustment, and if receiving this information, the group delegate should perform adjustment according to the information, and then performs step 203. The third typeof information indicates abort or prohibiting sending, such as rejecting the group to access the network, at the same time, a timer may be configured for the MSs in the group, and the MSs in the group can access the network again when the timer expires. The time duration of the timer may be configured with a new value, and may be referred to as a group timer. The value may be configured according to practical requirements, and may be different from the time duration of a conventional timer for abort in the network. The above three types of information may be used individually or in combination. For example, the first typeof information may be given to one part of group members in the group, and the third type of information may be given to the other one part of group members in the group.

[122] It should also be noted that, if the GDC obtained by the BS does not meet the requirements of the BS, the BS includes a continue instruction in the message sent by the BS to make the group continue in sending the GDC, generally make the group delegate sending the GDC last time continue in sending the GDC, and further guarantee that the BS can correctly receive the GDC. Table 9 shows ACK information of group ranging codes which is added in a ranging ACK signaling sent to the MSs in the group by the BS.

[123] Asmentioned previously, if the MSs receive continue or abort information from the BS, the selected group delegate is not changed; however, if the MSs receive success information, the selected group delegate changes back into a group member.

[124] It should also be noted that, if there is a time difference between the MSs, in order to prevent losing the information sent by the BS, the group members and/or the group delegate may need to receive the information from the BS in advance.

[125] The MSs in the group will respond to different ACK information with different responses. For example, if success information is received as shown in FIGURE 2, the MSs will obtain an initial value and end value of a backoff window, and access the

network after performing backoff processing. It should be noted that, when the initial value and end value of the backoff window are defined, a window space larger than that of a general subscriber is considered to decrease conflict and access delay caused when a large number of M2M access the network. Abort information indicates that all or a particular part of MSs in the group will access the network after a delay time (according to an abort timer). Continue information indicates that the group delegate in the M2M group will adjust its own timing or power parameters to continue sending the GDC of the group.

[126] Table 10

[127]

Syntax	Size (bit)	Description
Initial ranging backoff start for M2M Group	4	Initial backoff window size for initial ranging contention, expressed as a power of 2. Values of n range 0-15
Initial ranging backoff end for M2M Group	4	Final backoff window size for initial ranging contention, expressed as a power of 2. Valuesof n range 0-15

[128] In step 205, the MSs allowed accessing the network in the group receive backoff information which is sent by the BS and is contained in a superframe header for the group, individual or the prior art, perform backoff processing, select a ranging opportunity after the backoff processing, randomly select an IRC, and send the IRC to the BS.

[129] In step 206, the MSs sending the IRC receive a RNG-ACK message and/or a CDMA Allocation A-MAP IE message from the BS, where the RNG-ACK message and/or the CDMA Allocation A-MAP IE message includes a response of the BS to the detected IRC.

[130] In step 207, the MSs send a RNG-REQ message to the BS after receiving the RNG-ACK message containing success ACK information of the ranging signal, and/or receiving a corresponding CDMA Allocation A-MAP IE message, and/or receiving a corresponding group access resource allocation message, to inform the BS of information containing the MSs' IDs, and continue in accessing the network.

[131] FIGURE 3 illustrates an example operation between an MS and a BS for the MS to access the network in a mobile communication system according to a second embodiment of the present invention. Although not shown in the drawings, each of the MS and the BS includes at least a sender, a receiver, and a controller, and the sender

and the receiver transmit and receive messages, and the controller of the MS and BS controls the operations according to the second embodiment of the present invention.

[132] Referring to FIGURE 3, in step 301, MSs in a group determine a GDC of the group and corresponding resources according to a message sent by a BS.

[133] In step 302, the MSs in the group determine a group delegate of the group according to the message sent by the BS. It should be note that, step 302 may be performed before step 301, and the determining of the group delegate is the same as step 201 of FIGURE 2, and will not be described in detail.

[134] In step 303, the group delegate sends the GDC of the group to the BS in a ranging opportunity.

[135] In step 304, each MS in the group receives a RNG-ACK message and/or a group access resource allocation message from the BS.

[136] In step 305, the MSs allowed to access the network in the group send an IRC pre-allocated to the MS to the BS in the ranging opportunity. The ranging opportunity may be pre-allocated to the MS.

[137] It should be noted that, in step 305, each MS allowed to accessthe network in the group may be preconfigured with the ranging opportunity and IRC to reduce or eliminate any conflicts from occurring when the MSs are allowed to access the network in the group access the network, and further allow the MSs to successfully access the network.

[138] In step 306, the MSs sending the IRC listen to and receive a RNG-ACK message and/or a CDMA Allocation A-MAP IE message from the BS, where the RNG-ACK message and/or the CDMA Allocation A-MAP IE message includes a response of the BS to the detected IRC.

[139] In step 307, the MSs send a RNG-REQ message to the BS after receiving the RNG-ACK message includingsuccess ACK information of the ranging signal, and/or receiving a corresponding CDMA Allocation A-MAP IE message, and/or receiving a group access resource allocation message, to inform the BS of information containing the MSs' IDs, and continue in accessing the network.

[140] The difference between the first embodiment and the second embodiment lies in the difference between step 205 and step 305.

[141] The sequence of step 201 and step 202 may be changed as long as the two steps areperformed before step 203. In some cases, the time of performing the two steps in advance is not limited. Similarly, steps 301 and 302 are similar with steps 201 and 202.

[142] It should be noted that, steps 205 through 206 and steps 305 through 306 may be omitted in some cases. Steps 201 and/or 202 and steps 301 and/or 302 may be implemented according to a third embodiment.

[143] FIGURE 4 illustrates an example method for selecting a group delegate through

communication between an MS and a BSaccording to certain embodiments of the present invention.

[144] In step 401, a MS in the group receives a message sent by the BS, determines information of the group to which the MS belongs and the configuration of the group, which include at least one of: a group ID, a GDC and corresponding resources, such asa corresponding ranging opportunity, a frame number, a Group ID, a paging group ID, and so on.

[145] In step 402, the MSs in the group determine the group delegate of the group according to the message sent by the BS. The message sent by the BS includes at least one of: the value k (referring to step 202), a time parameter for selecting the group delegate, such as a frame number or a superframe number (referring to "(mod (group member ID, f(k, frame number)") in step 202), and the number of MSs in the group.

[146] In step 403, the MS that will become the group delegate sends a message to the BS, to inform the BS that the MS will become the group delegate.

[147] In step 404, the BS sends a message to the MSs in the group, and responds to the MS which will become the group delegate. The response may be sent to the group delegate or to the group.

[148] The IRC in the above embodiments may be an IRC in the conventional system, and may also be an IRC specially allocated to the MSs in the group. The IRC in the above embodiments may be sent in a ranging opportunity in the conventional system, and may also be sent in a ranging opportunity specially allocated to the MSs in the group. In additional, as in the ranging opportunity in the conventional system, both the IRC in the conventional system and the IRC specially allocated to the MSs in the group may be sent.

[149] In the above embodiments, the M2M group and the ranging opportunity are only examples, and the method may be applied to other groups and opportunities in practical applications.

[150] In summary, in the network access method of the MS provided by the embodiments of the present invention, a large number of MSs are delegated in groups, the group delegate in each group may request the BS through one or more GDCs to access the network,after receiving the message of allowing accessing the network, the MSs in this group send the IRC request or directly sends the RNG-REQ message to the BS to access the network. Since the MSs are delegated in groups in the various embodiments of the present invention, the number of MSs sending the access codes is decreased relatively, and thus the conflict occurred when the MSs access the network can be decreased.

[151] Further, in the embodiments of the present invention, the MSs allowed to accessthe network in the group may be configured with different IRCs, so that the MSs request to

access the network with different IRCs to reduce or eliminate any conflicts when the MSs access the network.

[152] As can be seen, since the MSs are delegated in groups, that is, the number of MSs sending the IRC in a period of time is decreased, potential conflicts when the MSs access the network can be decreased.

[153] Further, in the present invention, the MSs in the group which are allowed to access the network may be allocated with different IRCs, so that each MS may request to access the network using different IRCs, to avoid any conflictswhen the MSs access the network.

[154] Other various effects may have been directly or implicitly disclosed in the detailed description according to the embodiments of the present invention.

[155] The foregoing is only the preferred examples of the present invention and is not used to limit the protection scope of the present invention. Any modification, equivalent substitution and improvement without departing from the principle of the present invention are within the protection scope of the present invention.

[156] Although the present disclosure has been described with an exemplary embodiment, various changes and modificationsmay be suggested to one skilled in the art. It is intended that the present disclosure encompass such changes and modifications as fall within the scope of the appended claims.

Claims

[Claim 1] A network reentry method in a mobile communication system, the method comprising:
sending, by a group delegate Mobile Station (MS) among a plurality of MSs of a group, a ranging code based on a group Identifier (ID) to a Base Station (BS); and
receiving, by the MSs, a Ranging-Response (RNG-RSP) message comprising a ranging status for the group from the BS.

[Claim 2] The method of claim 1, further comprising, if the ranging status for the group indicates success, sending, by each of the MSs, a ranging code based on an MS ID to the BS to initiate a network reentry procedure.

[Claim 3] The method of claim 1, further comprising, if the ranging status for the group indicates abort, starting, by each of the MSs, a ranging abort timer and aborting a ranging procedure until the ranging abort timer expires.

[Claim 4] The method of claim 1, further comprising, if the ranging status for the group indicates continue, adjusting, by the group delegate MS, a parameter of the ranging code based on the group ID and sending the ranging code comprising the adjusted parameter to the BS.

[Claim 5] A network reentry method at a Base Station (BS) in a mobile communication system, the method comprising:
allocating a dedicated ranging code to a group delegate Mobile Station (MS) among a plurality of MSs of a group;
receiving a ranging code based on a group Identifier (ID) generated according to the dedicated ranging code from the group delegate MS; and
sending a Ranging-Response (RNG-RSP) message comprising a ranging status for the group to the MSs.

[Claim 6] The method of claim 5, wherein the ranging status for the group comprises one of success, abort, and continue.

[Claim 7] The method of claim 6, further comprising, if the ranging status for the group indicates success, receiving a ranging code based on an MS ID from each of the MSs.

[Claim 8] The method of claim 6, further comprising, if the ranging status for the group indicates continue, receiving, from the group delegate MS, a ranging code in which a parameter of the ranging code based on the group ID is adjusted.

[Claim 9] A network reentry apparatus in a mobile communication system, the apparatus comprising:
a controller by which a group delegate Mobile Station (MS) among a plurality of MSs of a group is configured to determine a ranging code based on a group Identifier (ID);
a sender by which the group delegate MS is configured to send the ranging code based on the group ID to a Base Station (BS); and
a receiver by which the MSs is configured to receive a Ranging-Response (RNG-RSP) message comprising a ranging status for the group from the BS.

[Claim 10] The method of claim 1 or the apparatus of claim 9, wherein the MSs are configured to wait for receiving the RNG-RSP message for a predetermined period of time.

[Claim 11] The apparatus of claim9, wherein if the ranging status for the group indicates success, the controller is configured to control each of the MSs to send a ranging code based on an MS ID to the BS to initiate a network reentry procedure.

[Claim 12] The apparatus of claim 9, wherein if the ranging status for the group indicates abort, the controller is configured to controleach of the MSs to start a ranging abort timer and abort a ranging procedure until the ranging abort timer expires.

[Claim 13] The apparatus of claim 9, wherein if the ranging status for the group indicates continue, the controller is configured to controleach of the MSs to adjust a parameter of the ranging code based on the group ID and send the ranging code comprising the adjusted parameter to the BS.

[Claim 14] A network reentry apparatus at a Base Station (BS) in a mobile communication system, the apparatus comprising:
a controller configured to allocate a dedicated ranging code to a group delegate Mobile Station (MS) among a plurality of MSs of a group;
a receiver configured to receive a ranging code based on a group Identifier (ID) generated according to the dedicated ranging code from the group delegate MS; and
a sender configured to send a Ranging-Response (RNG-RSP) message comprising a ranging status for the group to the MSs.

[Claim 15] The apparatus of claim 14, wherein the ranging status for the group comprises at least one of success, abort, and continue.

[Claim 16] The apparatus of claim 15, wherein the receiver is configured to, if the ranging status for the group indicates success, receive a ranging code based on an MS ID from each of the MSs.

[Claim 17] The apparatus of claim 15, wherein the receiver is configured to, if the ranging status for the group indicates continue, receive a ranging code in which a parameter of the ranging code based on the group ID is adjusted, from the group delegate MS.

[Claim 18] The method of claim 1 or claim 5 or the apparatus of claim 9 or 14, wherein the MSs are configured to randomly select the group delegate MS.

[Claim 19] The method of claim 2 or claim 6 or the apparatus of claim 11 or claim 15, wherein the MSs are configured to, if the ranging status for the group indicates success, change the group delegate MS.

[Claim 20] The method of claim 3 or claim 4 or claim 6 or the apparatus of claim 12 or claim 13 or claim 15, wherein the MSs are configured to, if the ranging status for the group indicates abort or continue, not change the group delegate MS.

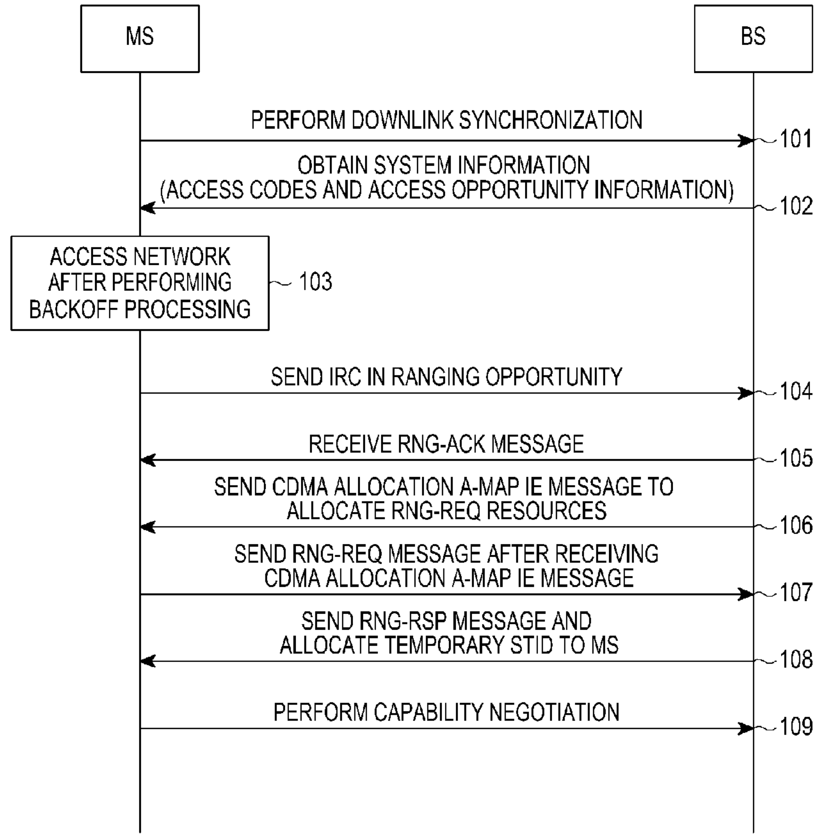
[Claim 21] The method of claim 1 or claim 5 or the apparatus of claim 9 or claim 14, wherein the ranging code based on the group ID is orthogonal with an additional ranging code for application, the controller configured to generate an additional ranging code from a Zadoff-Chu sequence having a cyclic shift function.

[Claim 22] The method or the apparatus of claim 21, further comprising four ranging opportunities in which the ranging code based on the group ID and the additional ranging code are configured in a single frame.

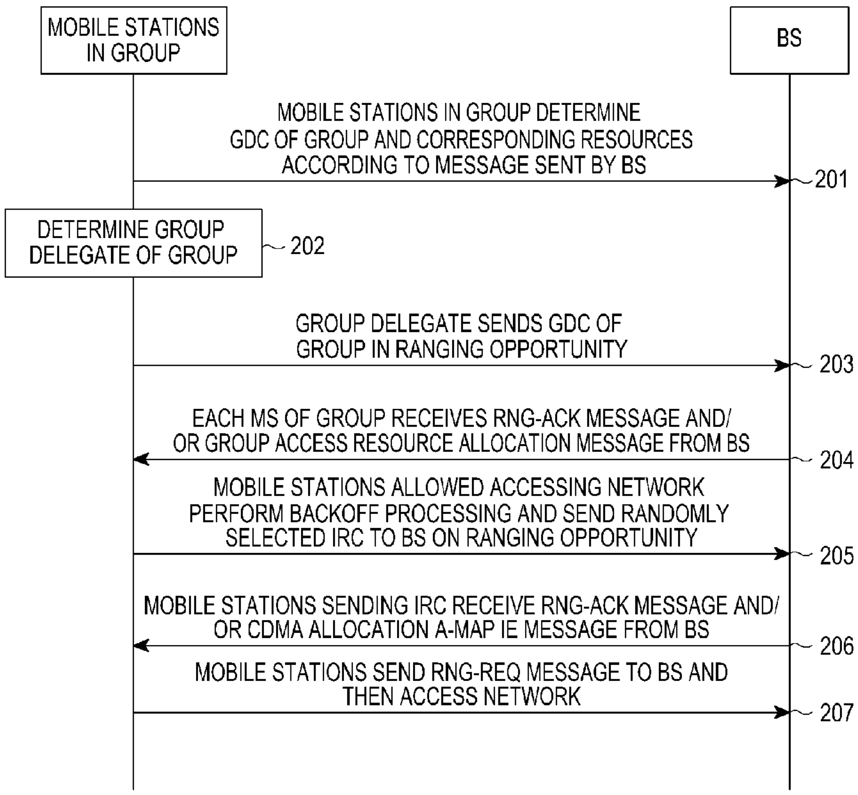
[Claim 23] The method or the apparatus of claim 21, further comprising one ranging opportunity in which the ranging code based on the group ID and the additional ranging code are configured in a single frame.

[Claim 24] The method or the apparatus of claim 21, further comprising two ranging opportunities in which the ranging code based on the group ID and the additional ranging code are configured in a single frame.

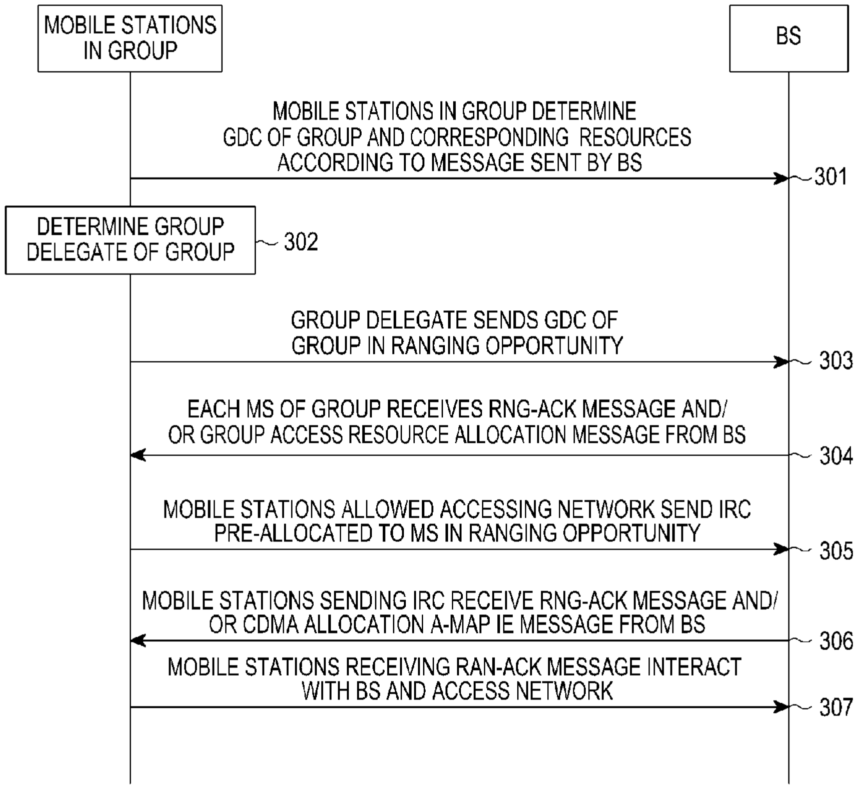
[Fig. 1]


MS
BS
PERFORM DOWNLINK SYNCHRONIZATION
101
OBTAIN SYSTEM INFORMATION
(ACCESS CODES AND ACCESS OPPORTUNITY INFORMATION)
102
ACCESS NETWORK
AFTER PERFORMING
BACKOFF PROCESSING
103
SEND IRC IN RANGING OPPORTUNITY
104
RECEIVE RNG-ACK MESSAGE
105
SEND CDMA ALLOCATION A-MAP IE MESSAGE TO
ALLOCATE RNG-REQ RESOURCES
106
SEND RNG-REQ MESSAGE AFTER RECEIVING
CDMA ALLOCATION A-MAP IE MESSAGE
107
SEND RNG-RSP MESSAGE AND
ALLOCATE TEMPORARY STID TO MS
108
PERFORM CAPABILITY NEGOTIATION
109

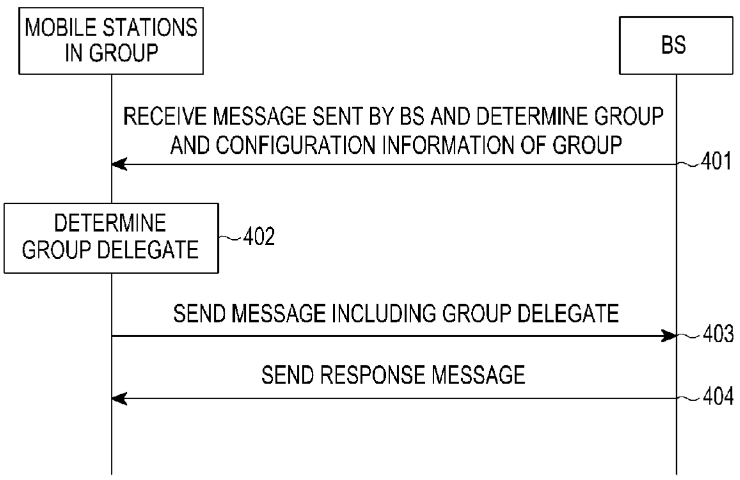
[Fig. 2]


MOBILE STATIONS
IN GROUP
BS
MOBILE STATIONS IN GROUP DETERMINE
GDC OF GROUP AND CORRESPONDING RESOURCES
ACCORDING TO MESSAGE SENT BY BS
201
DETERMINE GROUP
DELEGATE OF GROUP
202
GROUP DELEGATE SENDS GDC OF
GROUP IN RANGING OPPORTUNITY
203
EACH MS OF GROUP RECEIVES RNG-ACK MESSAGE AND/
OR GROUP ACCESS RESOURCE ALLOCATION MESSAGE FROM BS
204
MOBILE STATIONS ALLOWED ACCESSING NETWORK
PERFORM BACKOFF PROCESSING AND SEND RANDOMLY
SELECTED IRC TO BS ON RANGING OPPORTUNITY
205
MOBILE STATIONS SENDING IRC RECEIVE RNG-ACK MESSAGE AND/
OR CDMA ALLOCATION A-MAP IE MESSAGE FROM BS
206
MOBILE STATIONS SEND RNG-REQ MESSAGE TO BS AND
THEN ACCESS NETWORK
207

[Fig. 3]


MOBILE STATIONS IN GROUP
BS
MOBILE STATIONS IN GROUP DETERMINE GDC OF GROUP AND CORRESPONDING RESOURCES ACCORDING TO MESSAGE SENT BY BS
301
DETERMINE GROUP DELEGATE OF GROUP
302
GROUP DELEGATE SENDS GDC OF GROUP IN RANGING OPPORTUNITY
303
EACH MS OF GROUP RECEIVES RNG-ACK MESSAGE AND/ OR GROUP ACCESS RESOURCE ALLOCATION MESSAGE FROM BS
304
MOBILE STATIONS ALLOWED ACCESSING NETWORK SEND IRC PRE-ALLOCATED TO MS IN RANGING OPPORTUNITY
305
MOBILE STATIONS SENDING IRC RECEIVE RNG-ACK MESSAGE AND/ OR CDMA ALLOCATION A-MAP IE MESSAGE FROM BS
306
MOBILE STATIONS RECEIVING RAN-ACK MESSAGE INTERACT WITH BS AND ACCESS NETWORK
307

[Fig. 4]


MOBILE STATIONS IN GROUP
BS
RECEIVE MESSAGE SENT BY BS AND DETERMINE GROUP AND CONFIGURATION INFORMATION OF GROUP
401
DETERMINE GROUP DELEGATE
402
SEND MESSAGE INCLUDING GROUP DELEGATE
403
SEND RESPONSE MESSAGE
404