CLAIMS

1. An automatic registration algorithm for a low-voltage distribution network carrier terminal, comprising the following steps:

1) a carrier module of a concentrator starts registration of adjacent nodes of the concentrator:

1.1) the carrier module of the concentrator broadcasts a registration command, which can be relayed and is configured to start the registration of the adjacent nodes of the concentrator, to a carrier node,

1.2) non-adjacent nodes of the concentrator receiving the registration command of the step 1.1) cancel their home domain identifications;

1.3) adjacent nodes of the concentrator receiving the registration command of the step 1.1) perform a carrier node register process;

1.4) when a register action silence timer built in the concentrator exceeds a predetermined time interval, entering a step 2);

2) the carrier module of the concentrator starts registration of non-adjacent nodes of the concentrator:

2.1) the carrier module of the concentrator broadcasts a registration command, which can be relayed and is configured to start the registration of the non-adjacent nodes of the concentrator, to a carrier node,

2.2) non-adjacent nodes of the concentrator receiving the registration command of the step 2.1) perform the carrier node register process;

2.3) when a register action silence timer built in the concentrator exceeds a predetermined time interval, entering a step 3);

3) the carrier module of the concentrator starts supplementary registration of the adjacent nodes and the non-adjacent nodes of the concentrator:

3.1) the carrier module of the concentrator broadcasts a registration command, which can be relayed and is configured to start the supplementary registration of the adjacent nodes and the non-adjacent nodes of the concentrator, to a carrier

node;

3.2) the adjacent nodes and the non-adjacent nodes of the concentrator that receive the registration command of the step 3.1) and have not registered perform the carrier node register process;

3.3) when a register action silence timer built in the concentrator exceeds a predetermined time interval, ending;

wherein, the carrier node register process of the steps 1)-3) includes the following steps:

(1) each carrier node receiving the registration command cancels its own home domain identifications, enters a register state machine initial state, and sets a register state machine timer;

(2) each carrier node in the register state machine initial state empties its own adjacent domain node table and adjacent concentrator table, enters a register state machine domain-searching state, and sets a register state machine timer; wherein, the carrier nodes which are also collectors further receive a table searching command transmitted from the concentrator, and start built-in function modules to search non-carrier meters managed by these nodes;

(3) each carrier node in the register state machine domain-searching state broadcasts a domain searching request which cannot be relayed to the concentrator and other carrier nodes, and sets the register state machine timer to a random time interval;

(4) domain carrier nodes and concentrators receiving the domain searching request reversely transmit response messages which cannot be relayed to adjacent nodes which are searching domains, and each concentrator receiving the domain searching request updates a built-in register action silence timer thereof at the same time;

(5) when a carrier node which is searching domains receives all response messages returned from adjacent domain carrier nodes and concentrators, it checks

the signal quality of each response message, obtains signal quality parameters capable of measuring the proximity of the nodes, and stores the signal quality parameters and the home domain information in the response message into corresponding items of its own adjacent domain node table and adjacent concentrator table;

(6) repeatedly performing the steps (3) to (5) according to a predetermined number of times:

when the number of the response times belonging to the same home domain reaches a predetermined threshold value, performing a home domain determination algorithm to determine the home domain of the carrier node, and stopping the transmission of the domain searching request message;

(7) each carrier node that has determined its home domain registers to the concentrator of its home domain:

if the carrier node is a collector, entering a step (8);

if the carrier node is a carrier meter, entering a step (11);

(8) entering a register state machine register-data-request state, and setting a register state machine timer;

(9) sending a register data request command to a function module, entering a register state machine waiting-for-data state, and setting a register state machine timer;

(10) receiving a response message returned from the function module:

if the response message returned from the function module indicates that the managed non-carrier meters are all registered, the carrier node enters a register state machine register-completed state, sets a sleep timer, and enters a step (14);

if the response message returned from the function module is register data of a non-carrier meter, transforming the response message into a meter number register message, and entering a step (11);

(11) entering a register state machine waiting-for-active-report state, setting

the register state machine timer to a random time interval, and preparing to send the meter number register message; when a predetermined time is reached, sending the meter number register message which can be relayed to a concentrator of the home domain, entering a register state machine active-report state, and setting the register state machine timer to a random time interval again;

(12) a concentrator receiving the meter number register message reversely transmits a register confirmation message which can be relayed to the carrier node which is being registered, and simultaneously updates the register action silence timer;

(13) the carrier node, which is being registered, receives the register confirmation message returned from the concentrator:

if the carrier node is a collector, sending a confirmation message to the function module, and returning to the step (9);

if the carrier node is a carrier meter, entering the register state machine register-completed state, setting a sleep timer, and entering a step (14);

(14) when all carrier nodes receiving the registration command enter the register state machine register-completed state, stopping the transmission of the meter number register message.

2. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to claim 1, wherein, the home domain determination algorithm of the step (6) includes the following steps:

① a carrier node checks the message signal source of a received response message;

if the response message is sent from a concentrator, entering a step ②;

if the response message is sent from a domain carrier node, entering a step ④;

② according to the home domain identification, searching the table item corresponding to the concentrator in the adjacent concentrator table;

if the table item does not exist, establishing a new table item, writing the home domain identification, storing the signal quality parameters, initializing the count of the response messages of the concentrator into 1, and the count of the concentrator is added with 1;

if the table item has already existed, the signal quality parameters are inserted into a signal quality parameter table of the table item in order, and the count of the response messages of the concentrator is added with 1;

③ checking whether the current count of the response messages of the concentrator reaches a predetermined value;

if the predetermined value is reached, entering a step ⑥;

if the predetermined value is not reached, returning to the step (3);

④ according to the home domain identification, searching the table item corresponding to the domain carrier node in the adjacent domain node table;

if the table item does not exist, establishing a new table item, writing the carrier node identification and the home domain identification, storing the signal quality parameters, initializing the count of the response messages of the domain carrier node into 1, and the count of the domain carrier node is added with 1;

if the table item has already existed, the signal quality parameters are inserted into a signal quality parameter table of the table item in order, and the count of the response messages of the domain carrier node is added with 1;

⑤ checking whether the current count of the response messages of the domain carrier node reaches a predetermined value;

if the predetermined value is reached, entering a step ⑥;

if the predetermined value is not reached, returning to the step (3);

⑥ the median of the signal quality parameters in the signal quality parameter table of each table item of the adjacent concentrator table and the adjacent domain node table is obtained and placed into the first item of the signal quality parameter table of each table item;

⑦ respectively searching the minimums of the medians of the signal quality parameters in the adjacent concentrator table and the adjacent domain node table;

⑧ obtaining the home domain identification of the table item corresponding to each minimum, and determining the home domain according to the home domain identification.

3. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to claim 1 or claim 2, wherein, in the step (12) and the step (13), each carrier node receiving the meter number register message or the register confirmation message relays the received message; for a carrier node in the domain searching state or the actively reporting state, when it receives the meter number register message or the register confirmation message:

if the carrier node is in a non-domain state, a time avoidance algorithm is performed, and messages which are to be transmitted in the current transmission sequence are deleted;

if the carrier node is in a domain state, only the time avoidance algorithm is performed.

4. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to claim 3, wherein, the time avoidance algorithm is a conflict avoidance algorithm based on a physical-layer carrier sense multiple access (CSMA) technology.

5. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to any one of claims 1, 2 and 4, wherein, the register action silence timer is configured to record the duration when there is no domain searching action and register action in a district; the registration command adopts a wildcard domain identification, wherein a data domain includes a domain identifier,

which is configured to record the home domain identification of the concentrator that sends the registration command.

6. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to claim 3, wherein, the register action silence timer is configured to record the duration when there is no domain searching action and register action in a district; the registration command adopts a wildcard domain identification, wherein a data domain includes a domain identifier, which is configured to record the home domain identification of the concentrator that sends the registration command.

7. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to any one of claims 1, 2, 4 and 6, wherein, when receiving a domain searching request or a meter number register message, or when the number of times for broadcasting the registration command which can be relayed reaches a predetermined value, but no domain searching request and no meter number register message is received, the concentrator automatically stops broadcasting the registration command; for a carrier node in a non-domain state or an actively reporting state, when it receives a domain searching request, no response is generated.

8. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to claim 3, wherein, when receiving a domain searching request or a meter number register message, or when the number of times for broadcasting the registration command which can be relayed reaches a predetermined value, but no domain searching request and no meter number register message is received, the concentrator automatically stops broadcasting the registration command; for a carrier node in a non-domain state or an actively

reporting state, when it receives a domain searching request, no response is generated.

9. The automatic registration algorithm for a low-voltage distribution network carrier terminal according to claim 5, wherein, when receiving a domain searching request or a meter number register message, or when the number of times for broadcasting the registration command which can be relayed reaches a predetermined value, but no domain searching request and no meter number register message is received, the concentrator automatically stops broadcasting the registration command; for a carrier node in a non-domain state or an actively reporting state, when it receives a domain searching request, no response is generated.