Claims

1. An on-path re-addressing based routing and forwarding method, comprising: in a network using the on-path re-addressing based routing and forwarding method,

identifying each network element entity by means of a unique and invariable identifier ID, wherein all the network element entities in the network include hosts, devices, data and services, and the mapping relationship between the identifier ID of each network element entity and a corresponding network address is maintained by a service level-based resolution service system;

wherein the service level refers to differentiated service defined based on measurement, and the definition includes at least one of a service level defined based on response delay of network measurement, a service level defined based on geographic distance measurement, a service level defined based on semantic correlation measurement and calculation, and a service level defined based on any two or three types of the above information combinations;

after a network routing and switching device receives a network layer data message, rewriting a network address field and network address extension field of the network layer data message; and forming a forwarding message by means of message reconstruction according to the rewritten message network address field and network address extension field, and forwarding the forwarding message on the basis of a forwarding table, wherein the forwarding table can be calculated and maintained by using a location-based routing method;

wherein the network layer data message is forwarded in a network layer message format, and the data message comprises: a network address field, a network address extension field, an ID identification field which is unchanged during a session, and a preference field which carries application requirements for transmission; wherein the preference field comprises: application-related specific parameters; the application-related specific parameters include, service quality requirements and application preferences.

2. The on-path re-addressing based routing and forwarding method of claim 1,

wherein in the service level-based resolution service system, the resolution service system comprises one or more service levels, and is a distributed query service system which can maintain the mapping relationship between the identifier ID and a corresponding network address and which can provide resolution services of multiple service levels;

the resolution service system is a service level-based distributed system with a hierarchical structure; each distributed node constituting the distributed system maintains one or more neighborhood node lists, and the nodes in the one or more neighborhood node lists cooperatively respond to the same resolution request;

the mapping relationships between the identifications of all the identifiers ID and the corresponding network addresses are registered and managed in the resolution service system; and

wherein the resolution service system includes a registration service capability, a retrieval service capability, a query service capability and a management service capability.

3. The on-path re-addressing based routing and forwarding method of claim 2, wherein the service level-based distributed system with a hierarchical structure is of a single-layered structure or a multi-layered structure;

nodes at the same level in the distributed system have the same service level, while nodes at different levels have different service levels;

a serviceable node of a user on a certain service level indicates that the user can obtain resolution and query services on the service node according to the service performance corresponding to the service level; and

one service node possessing a certain user indicates that the service node can provide the resolution and query services to the user with the service performance corresponding to the service level.

4. The on-path re-addressing based routing and forwarding method of claim 2 or 3, wherein in the service level-based distributed system with a hierarchical structure, one user node possesses one or more serviceable nodes belonging to the same service level, if multiple serviceable nodes exist in a certain service level, then the service

level has and only has one service node as a master node;

wherein all the master nodes of each service level serving the user conform to a nested structure, all the users possessed by the user at master node at the service level j must also be the users possessed by the user at master node at levels higher than the service level j;

suppose that the user is u_i, $ms_{i,j}$ is the master node selected for u_i at the service level j, $\Phi(ms_{i,j})$ is a user set served by $ms_{i,j}$ of the master node, when the service level k is greater than the service level j, $\Phi(ms_{i,j}) \subset \Phi(ms_{i,k})$;

wherein the master node is defined or assigned by a selection function.

5. The on-path re-addressing based routing and forwarding method of claim 2, wherein the neighborhood node list is a locally autonomous node list maintained by the node itself, and the node selects service nodes in part of the network based on neighborhood judgment criteria to construct a neighborhood node list;

multiple neighborhood node lists can be established if multiple criteria are passed;

wherein the neighborhood judgment criteria include :

a neighborhood is established based on a network delay measurement criterion, if the delay between a node and a candidate neighborhood node is less than a certain threshold, then the candidate neighborhood node is added to the neighborhood node list;

a neighborhood is established based on a geographical distance criterion, if the physical distance between a node and a candidate neighborhood node is less than a preset distance threshold, the candidate neighborhood node is added to the neighborhood node list;

a neighborhood is established based on a semantic similarity criterion, if the node is highly associated with the content stored in the candidate neighborhood node, then the candidate neighborhood node is added to the neighborhood node list; wherein the correlation refers to similarity of the contents stored in two nodes through semantic calculation; and

a neighborhood is established based on a structural relation criterion, if all the service nodes constitute a tree-shaped structure, then descendant nodes or descendant's descendant nodes in the tree-shaped structure constitute a neighborhood.

6. The on-path re-addressing based routing and forwarding method of claim 2, wherein the nodes in one or more neighborhood node lists cooperatively respond to the same resolution request; and nodes in the neighborhood node list maintained by each node can provide services in place of the node itself or in parallel with the node;

wherein conditions for judging replaceable or parallel services include :

the node itself is overloaded and is difficult to respond to the request under the requirements of the service level, and the neighborhood nodes with the same service capability can provide the request with service meeting the level requirements;

the node itself does not store the required content, and the related neighborhood nodes have the required content and can provide the service of the service level required by the user; and

when high concurrent requests occur, multiple neighborhood nodes can meet the service requirements at the same time, and can perform request diversion.

7. The on-path re-addressing based routing and forwarding method of claim 1, wherein the information of the network address extension field comprises : multiple candidate storage address set information or reference information of the content corresponding to the destination ID identification, multiple candidate network address set information or reference information under the same device ID identification, and network layer processing indication information; wherein the reference information includes, pointers and offsets.

8. The on-path re-addressing based routing and forwarding method of claim 1, wherein the specific process of rewriting the network address field and the network address extension field of data message is as follows:

step 1) requesting the resolution service conforming to the response service level requirement from the resolution service system according to the ID identification carried by the data message, obtaining a new destination address under the ID identification, and rewriting the network address field of the data message using the

new destination address to obtain a rewritten network address field;

step 2) obtaining a candidate address set through the candidate address set information or its reference information in the network address extension field, base on the network state perceived by the network routing and switching device, and the network address and the network address extension field information possibly carried in the data message;

in the candidate address set which is constituted by the addresses queried from the resolution service system according to the ID identification, selecting part of the subset, reordering the selected addresses, selecting a proper address as a new destination address according to preset strategies, filling the new address destination into the network address field of the data message, screening part of the selected subset, and writing the screened content back to the corresponding position in the network address extension field; and

step 3) calculating part of the field information in the new network address extension field according to the network state perceived by the network routing and switching device, the network address extension field information possibly carried in the data message and preset strategies; then, rewriting the corresponding part of the network address extension field in the data message, and obtaining the rewritten NA extension field.

9. The on-path re-addressing based routing and forwarding method of claim 1, wherein specific process of reconstructing the message is as follows:

reconstructing the message of the rewritten network address field and the rewritten network address extension field into a message format supported by the current network, and forwarding the message according to a forwarding table of the new destination address.