CLAIMS

What is claimed is:

1. A network topology self-adapting data visualization method, wherein the method comprises:

preprocessing nodes and outputting the preprocessed nodes;

processing the preprocessed nodes by force guidance layout algorithm to form an initial network topology graph;

performing de-duplication processing for the duplicated preprocessed nodes in the initial network topology graph and outputting the de-duplicated nodes; and

forming an object network topology graph on the basis of the de-duplicated nodes;

wherein the force guidance layout algorithm comprises:

using a spring model to calculate elastic potential energy, the spring model comprises: $E_s = \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{1}{2} k(d(i,j) - s(i,j))^2$;

using an energy model to calculate dynamic potential energy on the basis of the elastic potential energy, the energy model comprises: $E = E_s + \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{r w_i w_j}{d(i,j)^2}$;

wherein the nodes i and j represent the euclidean distance of the two nodes by d(i, j), s(i, j) represents the natural length of the spring, k is the elastic coefficient, r is the electrostatic constant between the two nodes, w is the weight between the two nodes, E_s is the elastic potential energy, and E the dynamic potential energy.

2. The network topology self-adapting data visualization method according to claim 1, wherein the step of preprocessing nodes and outputting the preprocessed nodes comprises:

obtaining node color and node size of each node;

performing data normalization for the node color and node size of each node and obtaining a normalized value of each node; and

determining the corresponding interval of each node according to the normalized value and partition threshold of each node, and outputting the interval of each node as a preprocessed node.

3. The network topology self-adapting data visualization method according to claim 1, wherein the step of performing de-duplication processing for the duplicated preprocessed nodes in the initial network topology graph and outputting the de-duplicated nodes comprises:

obtaining coordinate data of each preprocessed node of the initial network topology graph, wherein the coordinate data comprises a coordinate x and a coordinate y;

placing the preprocessed nodes with the same coordinate data into a cache list;

traversing the cache list, selecting two preprocessed nodes with the same coordinate data, adding or subtracting random numbers from the coordinate x and coordinate y of the two preprocessed nodes, and forming two updated nodes; iterating through the cache list until no preprocessed node with the same coordinate data exists; and

determining whether the preprocessed nodes with the same coordinate data as the updated nodes exist; if the preprocessed nodes exist, place the updated nodes and the preprocessed nodes into the cache list; if the preprocessed nodes do not exist, the updated nodes are output as the de-duplicated nodes.

4. The network topology self-adapting data visualization method according to any one of claims 1-3, wherein the method further comprises:

converting the file format for the de-duplicated nodes and outputting the de-duplicated nodes

in json file format.

5. A network topology self-adapting data visualization device, wherein the device comprises:

a node preprocessing unit configured to:

preprocess nodes; and

output the preprocessed nodes;

an initial network topology graph forming unit configured to process each preprocessed node by force guidance layout algorithm to form an initial network topology graph;

a de-duplication processing unit configured to perform de-duplication processing for the duplicated preprocessed nodes in the initial network topology graph and output the duplicated preprocessed nodes; and

an object network topology graph forming unit configured to form an object network topology graph on the basis of the de-duplicated nodes;

wherein the force guidance layout algorithm comprises:

using a spring model to calculate elastic potential energy, the spring model comprises: $E_s = \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{1}{2} k(d(i,j) - s(i,j))^2$;

using an energy model to calculate dynamic potential energy on the basis of the elastic potential energy, the energy model comprises: $E = E_s + \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{r w_i w_j}{d(i,j)^2}$;

wherein the nodes i and j represent the euclidean distance of the two nodes by d(i, j), s(i, j) represents the natural length of the spring, k is the elastic coefficient, r is the electrostatic constant between the two nodes, w is the weight between the two nodes, E_s is the elastic potential energy, and E is the dynamic potential energy.

6. The network topology self-adapting data visualization device according to claim 5, wherein the node preprocessing unit comprises:

a node obtaining sub-unit configured to obtain the node color and the node size of each node;

a data normalization sub-unit configured to perform data normalizing data for the node color and node size of each node and obtain a normalized value of each node; and

a preprocessed node obtaining sub-unit configured to determine the corresponding interval of each node according to the normalized value and partition threshold of each node, and output the interval of each node as a preprocessed node.

7. The network topology self-adapting data visualization device according to claim 5, wherein the de-duplication processing unit comprises:

a coordinate data obtaining sub-unit configured to obtain coordinate data of each preprocessed node of the initial network topology graph, wherein the coordinate data comprises a coordinate x and a coordinate y;

a data cache sub-unit configured to place the preprocessed nodes with the same coordinate data into a cache list;

a node de-duplication processing sub-unit configured to traverse the cache list, select two preprocessed nodes with the same coordinate data, add or subtract random numbers from the coordinate x and coordinate y of the two preprocessed nodes, and form two updated nodes; iterate through the cache list until no preprocessed node with the same coordinate data exists; and

a de-duplicated node output sub-unit configured to determine whether the preprocessed nodes with the same coordinate data as the updated nodes exist; place the updated nodes and the preprocessed nodes into the cache list if the preprocessed nodes exist; output the updated nodes as

the de-duplicated nodes if the preprocessed nodes do not exist.

8. The network topology self-adapting data visualization device according to any one of claims 5-7, wherein the device further comprises a format converting unit, the format converting unit is configured to:

convert the file format for the de-duplicated nodes; and

output the de-duplicated nodes in json file format.

9. A network topology self-adapting data visualization apparatus, wherein the apparatus comprises a processor and a storage, the storage stores computer-readable instruction, the computer-readable instruction is executed by the processor to execute the following steps:

preprocessing nodes and outputting the preprocessed nodes;

processing the preprocessed nodes by force guidance layout algorithm to form an initial network topology graph;

performing de-duplication processing for the duplicated preprocessed nodes in the initial network topology graph and outputting the de-duplicated nodes; and

forming an object network topology graph on the basis of the de-duplicated nodes;

wherein the force guidance layout algorithm comprises:

using a spring model to calculate elastic potential energy, the spring model comprises: $E_s = \sum_{i=1}^{n}\sum_{j=1}^{n}\frac{1}{2}k(d(i,j)-s(i,j))^2$;

using an energy model to calculate dynamic potential energy on the basis of the elastic potential energy, the energy model comprises: $E = E_s + \sum_{i=1}^{n}\sum_{j=1}^{n}\frac{rw_i w_j}{d(i,j)^2}$;

wherein the nodes i and j represent the euclidean distance of the two nodes by d(i, j), s(i, j)

represents the natural length of the spring, k is the elastic coefficient, r is the electrostatic constant between the two nodes, w is the weight between the two nodes, E_s is the elastic potential energy, and E is the dynamic potential energy.

10. The network topology self-adapting data visualization apparatus according to claim 9, wherein the step of preprocessing nodes and outputting the preprocessed nodes comprises:

obtaining node color and node size of each node;

performing data normalization for the node color and node size of each node and obtaining a normalized value of each node; and

determining the corresponding interval of each node according to the normalized value and partition threshold of each node, and outputting the interval of each node as a preprocessed node.

11. The network topology self-adapting data visualization apparatus according to claim 9, wherein the step of performing de-duplication processing for the duplicated preprocessed nodes in the initial network topology graph and outputting the de-duplicated nodes comprises:

obtaining coordinate data of each preprocessed node of the initial network topology graph, wherein the coordinate data comprises a coordinate x and a coordinate y;

placing the preprocessed nodes with the same coordinate data into a cache list;

traversing the cache list, selecting two preprocessed nodes with the same coordinate data, adding or subtracting random numbers from the coordinate x and coordinate y of the two preprocessed nodes, and forming two updated nodes; iterating through the cache list until no preprocessed node with the same coordinate data exists; and

determining whether the preprocessed nodes with the same coordinate data as the updated nodes exist; if the preprocessed nodes exist, place the updated nodes and the preprocessed nodes

into the cache list; if the preprocessed nodes do not exist, the updated nodes are output as the de-duplicated nodes.

12. The network topology self-adapting data visualization apparatus according to any one of claims 9-11, wherein the processor further executes a step of converting the file format for the de-duplicated nodes and outputting the de-duplicated nodes in json file format.

13. The network topology self-adapting data visualization apparatus according to claim 9, wherein the apparatus further comprises a user interaction device connected to the processor, the user interaction device is configured to receive a data visualization request input by the user and send the data visualization request to the processor; the data visualization request comprises the node; the processor is configured to obtain the object network topology graph based on the received data visualization request and send the object network topology graph to the display module; the user interaction device is configured to receive and display the object network topology graph.

14. The network topology self-adapting data visualization apparatus according to claim 9, wherein the apparatus further comprises a network interface connected to the processor, the network interface is connected to a remote storage device and an external display device, the network interface is configured to:

receive the node sent by the remote storage device and send the node to the processor; and

receive the object network topology graph sent by the processor and send the object network topology graph to the external display device.

15. The network topology self-adapting data visualization apparatus according to claim 9, wherein the storage stores a database, the database is configured to store the object network

topology graph.

16. A non-volatile computer-readable storage medium, wherein the non-volatile computer-readable storage medium stores one or more computer-readable instructions, the computer-readable instructions are executed by one or more processors to enable the one or more processors to execute the network topology self-adapting data visualization method according to claim 1.