```
{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13}

13

{1 ↔ 2, 2 ↔ 3, 3 ↔ 1, 1 ↔ 4, 1 ↔ 5, 1 ↔ 6,
 2 ↔ 7, 2 ↔ 8, 2 ↔ 9, 3 ↔ 10, 3 ↔ 11, 3 ↔ 12, 3 ↔ 13}
```

Figure 3. Network topology graph, general information (output in Wolfram Mathematica).

no arrows are bidirectional, which is analogous to two opposing edges with the same weight.

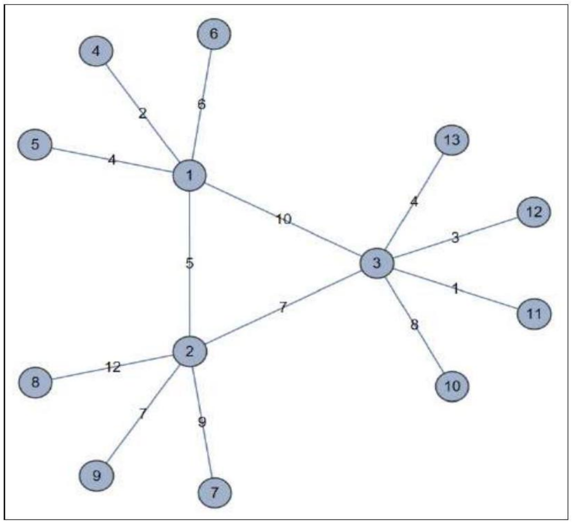

Figure 4. Network topology graph, connections with weights (output in Wolfram Mathematica).

The example output with specifying the LayeredEmbedding graph format, applying the vertex design option is shown in Fig. 5.

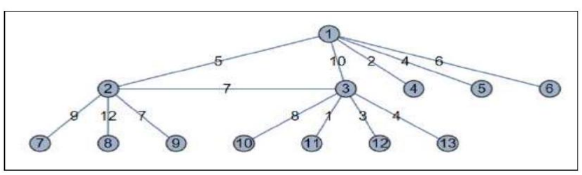

Figure 5. Network topology graph with LayeredEmbedding layout (output in Wolfram Mathematica).

The example output with specifying the LayeredDigraphEmbedding graph format, applying the vertex design options is shown in Fig. 6.

Let us consider one of the dynamic routing protocols, OSPF (Open Shortest Path First), as the example of the described network topology. This protocol is interesting

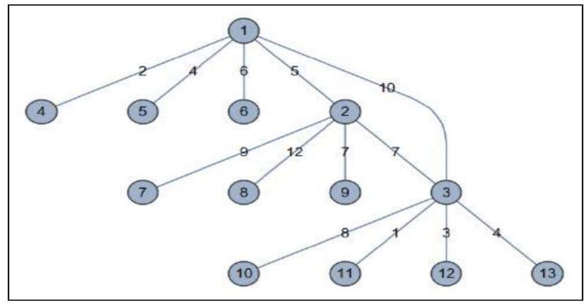

Figure 6. Network topology graph with LayeredDigraphEmbedding layout (output in Wolfram Mathematica).

because it uses the Dijkstra algorithm to find the shortest path [30].

The principle of the protocol is as follows:

1. Once routers are enabled, the protocol searches for directly connected neighbors and establishes communication with them.

2. Routers exchange information with each other about the networks connected and available to them – build a network map (network topology). This map is the same on all routers.

3. Based on this information, the SPF (Shortest Path First) algorithm is run, which calculates the best route to each network. This process is similar to building a tree, with the root being the router itself, and the branches being paths to available networks.

In the OSPF protocol, convergence occurs rather quickly due to the use of the Dijkstra algorithm [31].

Fig. 7 illustrates the example of solving the problem of finding the optimal route between two nodes in a network. The following Wolfram Mathematica functions were used: GraphDistance, NeighborhoodGraph, Sow, DirectedEdge, Placed, Union, and Flatten. Consider the following situation: in this initial network topology the communications are upgraded. Between nodes 2 and 3 a fiber optic is laid, which provides more bandwidth and data transfer speed. As a result of the replacement, the “cost” of transmitting data over this link decreases from 8 conventional units to 3. How will the changes affect the solution to the problem at hand: the optimal route between nodes 4 and 12 of the network?

When routers are included in the network, they check the speed capabilities of all available data channels. In our situation, routers 2 and 3 will determine that the communication between them has improved qualitatively. In accordance with the OSPF protocol, these devices on request will transmit this information about the topology change to the neighboring router 1. Now, in the future, when deciding on a path to transmit data from node 4