The Bonch-Bruevich St.Petersburg State University of Telecommunications

SELF-ORGANIZING COMMUNICATION NETWORK OF MULTI-AGENT ROBOTIC SYSTEMS

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SPbSUT)))

Motivation of research

- Popularization of robotic systems;

- Greatest interest is the robotics networking;

- The communication networks between the agents of multi-agent systems (robots) are designed to provide exchange of control and information messages between elements of the system

- Therefore, the main tasks of the networks' self-organization are:

  - to provide the network connectivity (liaison between the network nodes)

  - to provide the Quality of Service (QoS) traffic (maintaining the required quality of service traffic).

Communication network structure between the elements of the system
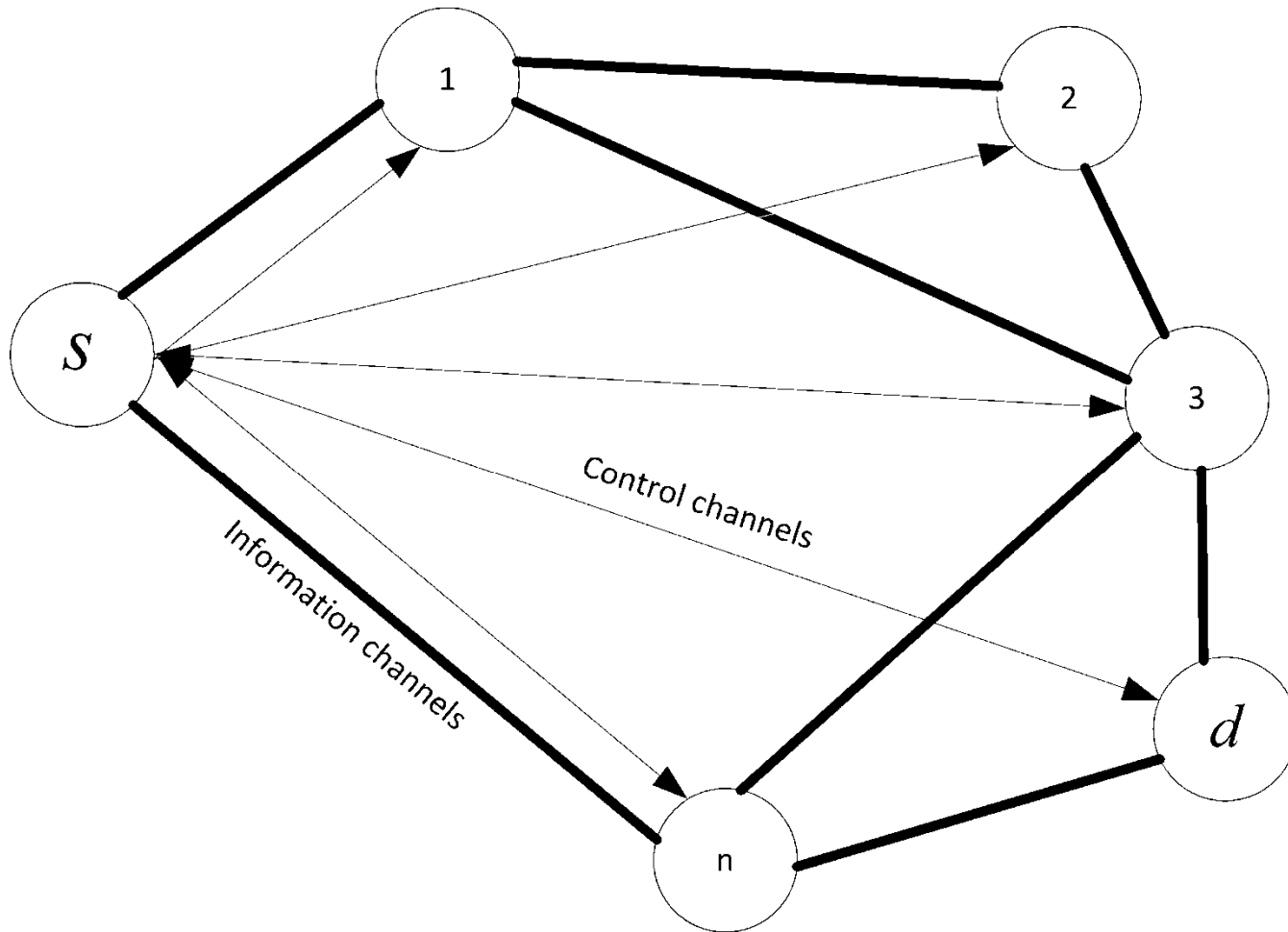
# Algorithm of selection traffic transmission routes
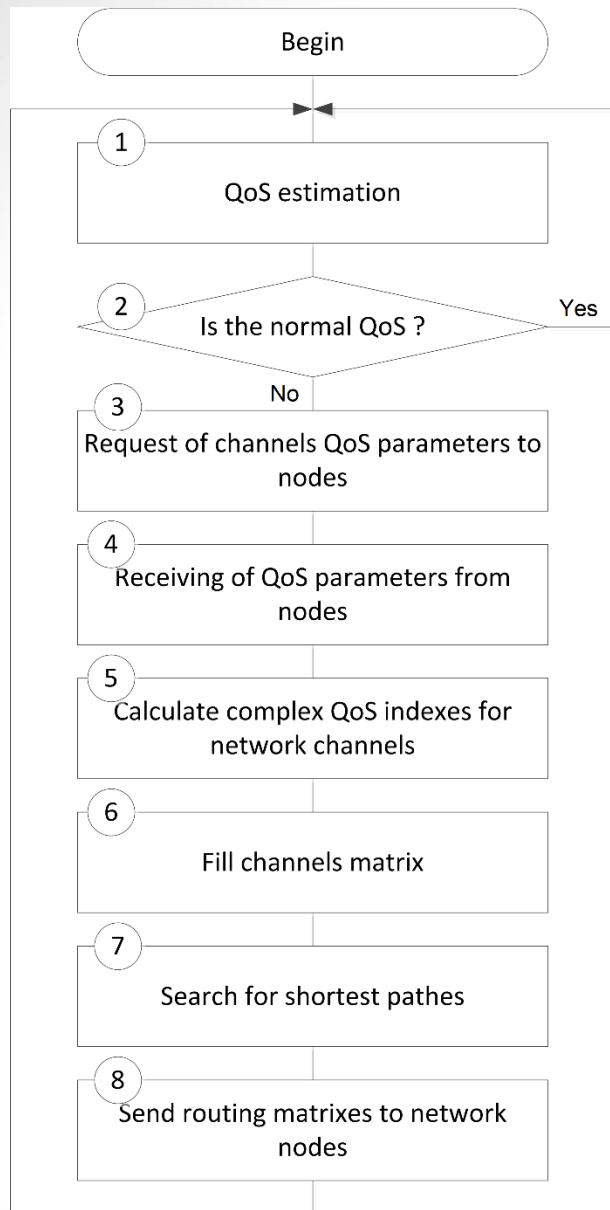
1. The control algorithm assumes control of the current quality of service of traffic.

2. If the traffic quality of service does not meet the standard (below a predetermined level), then the request of parameters' value of channels is initiated from the control elements (nodes).

3, 4. Control elements (nodes) collect the necessary data on the channel quality parameters and sent them to the control center.

5. Based on the values of the quality parameters of the channels, which are received from the control elements, the control center calculates the complex quality indicators Qij channels in accordance with the chosen methodology.

6. Based on the calculated integrated indicators of channel quality.

7. Find the shortest paths, base Floyd algorithm.

8. On the basis of results of the shortest paths search, the routing table is formed for all nodes in the network and sent to these nodes on the control channel.

# Algorithm of The method of weighted evaluation of a complex channel quality indicator

$$Q = k_{RSSI} \cdot q_{RSSI} + k_{PER} \cdot q_{PER} + k_{CAP} \cdot q_{CAP}, \quad k_{RSSI} + k_{PER} + k_{CAP} = 1$$

- q_{RSSI} signal quality (based on the RSSI signal level);
- q_{PER} transmission quality (based on the packet error ratio - PER);
- q_{CAP} throughput (based on bandwidth - Capacity);
- K_{PER} weighting coefficient of packet error;
- K_{CAP} weighting coefficient of throughput.

Improvement of the communication sustainability of the multi-agents system with the control center
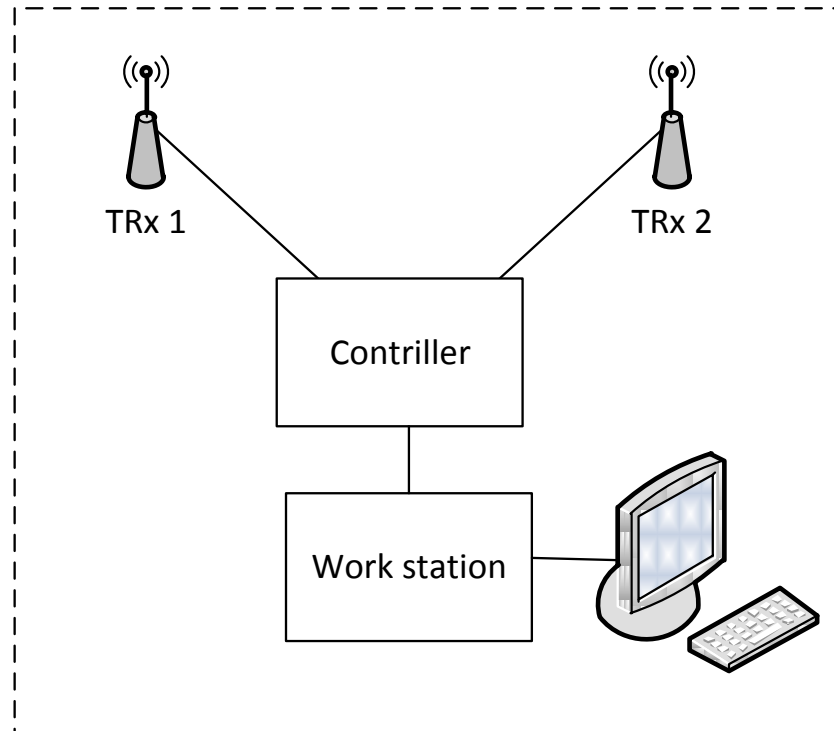
Algorithm of controller operation
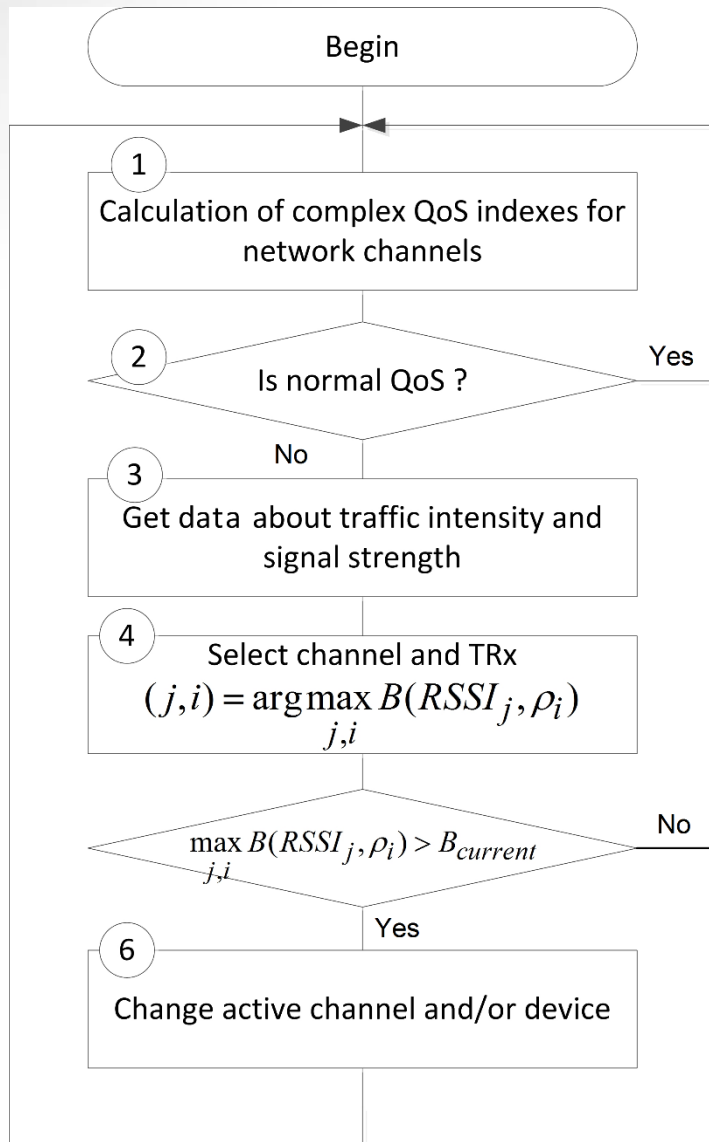
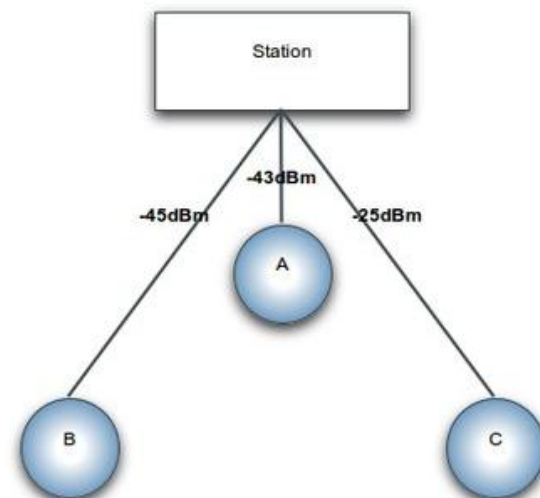$$q_{RSSI} = 1 - RSSI/RSSI_{max},$$

$$q_{IPLR} = PER/PER_{max},$$

$$q_{CAP} = 1 - CAP/CAP_{max},$$

where $RSSI_{max}$ - the maximum possible value of the parameter RSSI;

PER_{max} - maximum value of PER (is determined according to test results, the initial value of 0.5);

CAP_{max} - the maximum possible channel bandwidth.

# Practical realization the control center

Practical realization the control center (routes between control center and robots)

Each robot equipped by transceiver can be a source node or relay.

The path between the control center and a robot is a shortest path in the graph Which represents the network.

The weight of the edge in the graph is a complex channel quality indicator.
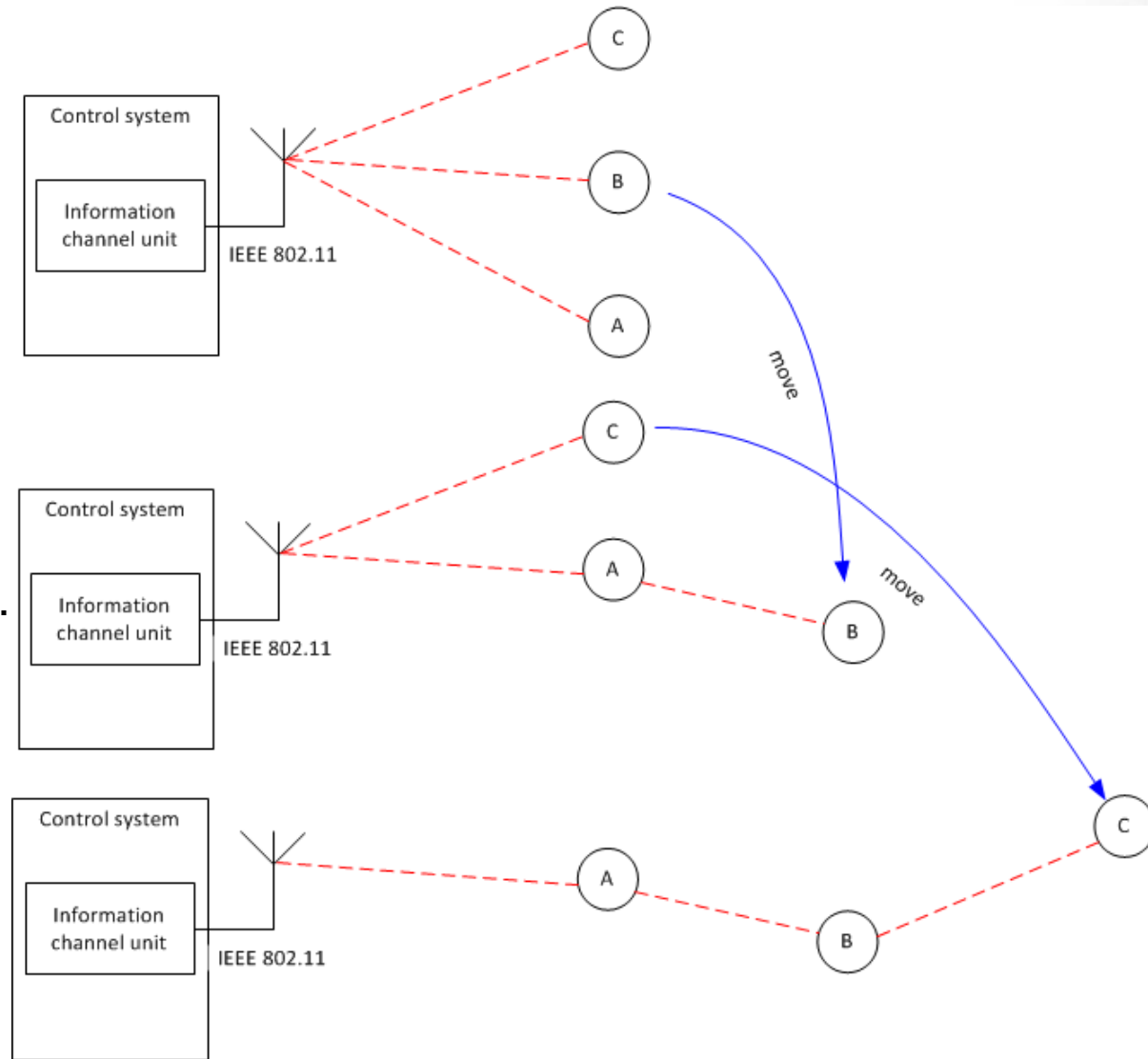
CONCLUSIONS

The algorithm of self-organizing network assumes control of wideband channel quality.

The self-organizing algorithm involves a comprehensive assessment of the quality of functioning channels between network elements (agents).

To improve the sustainability of the information channel network monitoring is used and implemented and the functions of selection and change of the working frequency channel are realized as well as the choice of the transceiver and the antenna device as part of the control center.

Thank you!

All questions send to mail:

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