EDUCATION COMPLEX "MULTI-AGENT TECHNOLOGIES FOR PARALLEL AND DISTRIBUTED INFORMATION PROCESSING IN TELECOMMUNICATION NETWORKS"

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Abstract: The paper describes education complex "Multi-agent Technologies for Parallel and Distributed Information Processing in Telecommunication Networks".

Keywords: multi-agent technologies, parallel and distributed information processing, telecommunication and computer networks.

ACM Classification Keywords: I.2. Artificial Intelligence

1. Introduction

Now multi-agent technologies and systems for data flow control in telecommunication and computer networks (TCN) are new and effective means of parallel and distributed information processing.

Making use of multicore Intel processors for implementation of multi-agent technologies enables conducting parallel and distributed multi-agent computations on modern multicore architecture of Intel processors.

2. Problem Set

Development of learning course “Multi-agent Technologies for Parallel and Distributed Information Processing in Telecommunication Networks” and embedding it into educational process on multicore Intel processors basis are very important education tasks.

So for their solution it is necessary to develop multi-agent technologies and systems for data flows control in telecommunication and computer networks. They are based on decomposition of complex (global) task on simple (local) condition-independent subtasks, which are distributed autonomously between processors-agents and solved by them in parallel till joint solution of a global task.

This problem can be solved by the use of multi-agent telecommunication network (MATCN).

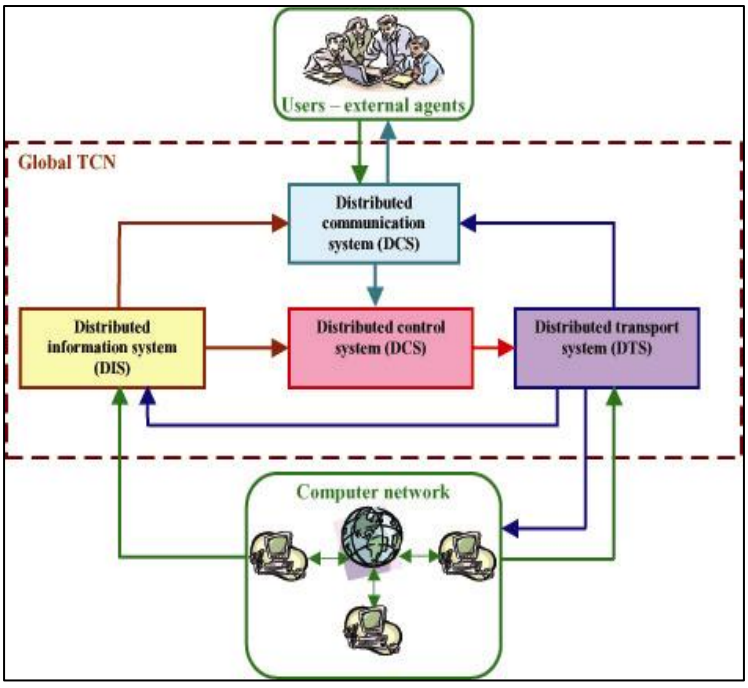

Fig. 1. Structure of multi-agent global telecommunication network

MATCN contains the following systems (Figure 1):

1. Distributed communication system (DCOMS) which processes queries of users–external agents;
2. Distributed control system (DCS) which provides control for data flow routing in telecommunication system;
3. Distributed information system (DIS) which receives information from computer network and then transmits them to DCOMS
4. Distributed transport system (DTS) provides knowledge exchange with computer network

3. Lectures Course

1. Status, convergence and TCN development tendencies.
2. Design of multi-agent distributed TCNs and principles of parallel processing of information flows.
3. Mathematical models and system analysis of distributed TCNs.
4. Principles of network control and data flow distribution.
5. Criteria of communicability and optimal information flow routes existence.
6. Methods of multi-agent routing of information flows and its implementation guidelines on multicore Intel processors.

4. Topics for Laboratory Works and Seminars

L-1. Multi-agent distributed telecommunication systems simulation library.

L-2. Practical work on multi-agent route planning for a group of mobile robots navigation.

L-3. Multi-agent data flow routing in distributed multi-agent TCNs.

L-4. Principles and software tools for data flow routers implementation on multicore Intel processors.

S-1. Methods of adaptive, multi-agent data flow routing.

S-2. Methods of multi-agent distributed TCNs simulation.

S-3. Principles of multi-agent parallel-distributed control of information flows on multicore Intel processors platform (10 hours).

S-4. Improvement of global TCNs on a basis of multi-agent and GRID technologies and multicore Intel processors (4 hours).

5. Telecommunication Networks Simulation Library

The TCN simulation library TCNSym is used in laboratory and practical works to demonstrate distributed information processing algorithms by the example of routing problem in TCNs.

The simulation environment is implemented using C# language for .NET platform. The user is allowed to edit network graph model, set up parameters for routers, channels and traffic generators, start simulation in both offline and online modes (Figure 2). In the online mode statistics about a network being simulated is updated in real-time and presented via graph plotting and packet movement in the network animation (Figure 3).

Simulation experiment results may be exported to MS Excel for further analysis.

Currently there are number of unicast and multicast routing algorithms implemented in the simulation library: static routing, distance-vector routing, link state routing, Q-routing, reverse path multicast, reverse path broadcast, truncated reverse path broadcast, core-based trees routing etc.

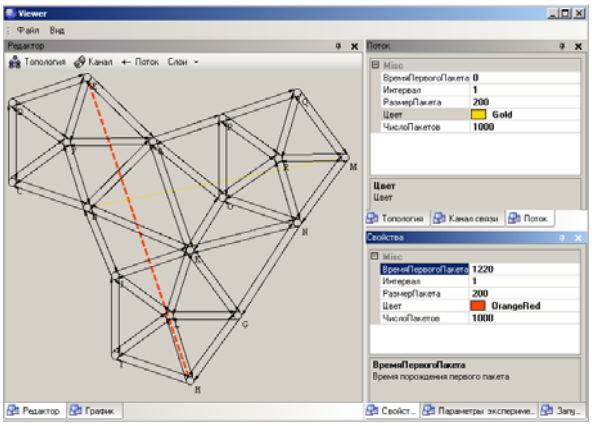

Figure 2. Setting up input data for a simulation experiment

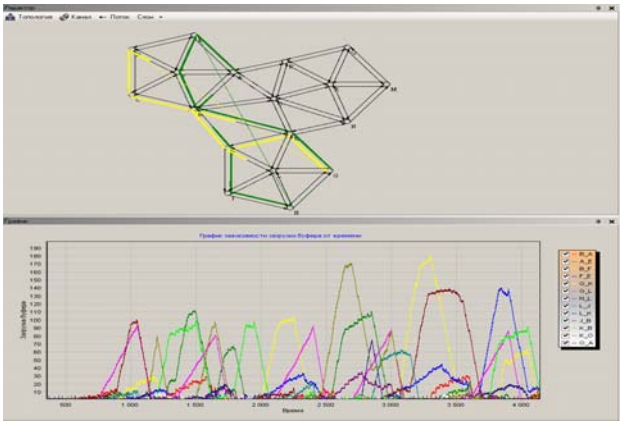

Figure 3. Running a simulation experiment in online mode

6. PH D Theses Related to the Project

- Veresov I.G. “Adaptive algorithms of information processing in multi-agent networks” (2003)
- Sheozhev A.M. “Development of neural network algorithms for medical-biological studies automation” (2004)
- Ostyuchenko I.V. “Multi-agent QoS control in telecommunication networks” (2006)
- Syrtzev A.V. “Mathematical and simulation modelling of neural network routers in multi-agent telecommunication systems” (2006)
- Kolotaev A.V. “Telecommunication network simulation library and language” (2006)

7. Conclusion

This learning course may be very useful for students who study multi-agent technologies in telecommunication networks, databases and control.

8. Acknowledgements

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