

Development of software for managing network resources based on the approach of software-configurable network

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Creating a scalable industrial automation systems that stores and processes large amounts of data and works on consumers demand as services (for example, for the design of complex products, decision support, planning and resource optimization, image processing and pattern recognition with non-destructive testing, etc.) requires new approaches to computer networks, because service work is carried out in an environment where neither the number of orders for the process nor the number of pre-existing resources cannot be known beforehand, and even dynamically change during computation.

One promising new approach involves the creation of distributed multiserver applications based on software-configurable networks, both once the tasks originally configurable and modifiable during operation of the system "on the fly" in real time, for example, depending on the characteristics of the input task flow.

To create intelligent software-configurable networks with a controlled distribution of the load on the network is proposed to use multi-agent technology, which allows to introduce elements of self-organization in the operation of considered networks for a rapid, flexible and effective response to emerging challenges in the service system, or the failure of any network resources for example, channels or computational elements. Created methods and tools will allow the automating of the process of adaptive dynamic load balancing on the network, while reconfiguring the network at the software level if necessary.

A mathematical model of the system includes a plurality of interconnected resources - computing power (servers) that are designed for different tasks, with different capacities, all of which are linked by a network relationships (count channels) data. At random times, tasks are coming into the system and each server creates a queue of tasks to perform. Each task has its value, as well as each server and the data transmission channel have their rates. Tasks characterized by computing features or data storage requirements, data volumes required computational power, etc., some of these characteristics may not be known until the end of the job. Each task and each computing resource in the network have an agent who control plan for the task and workload on its resource. Resource agent is primarily assesses the task ability of their performance on their site. If it is impossible - asks the neighboring agents of resources for assistance in solving the problem. As a result, the agents of servers talking to each other and the task-agents, knowing the requirements and deadlines for implementation, during which the current construction plan specifying the placement of tasks on servers that adapts as the arrival of new tasks, new servers-nodes connection or disable existing ones (with this can be considered a variable performance). Agents estimate the channel capacity of the chosen directions of transmission and build the most appropriate route. Negotiations are going to redistribute load in the network. Most free server "attract" a load from the other servers, and eventually, the load is evenly distributed over the network. With a corrupted server, if that happens, the problem "spill over" to other servers.

The implementation process includes the development of mathematical models for reconfigurable networks, classes of agents for their modeling, algorithms and operation logic of decision making by the agents on the distribution of resources in the network, protocols in the event of their negotiations and conflict resolution.