

# An Overview of the Agent Based Systems for the Business Process Management

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**Abstract:** Business process management systems (BPMS) are used in many organizations to reduce their routine business and administrative work. This paper focuses on the agent-based solutions for the business process management. The purpose of the paper is to describe the key concepts of the agent-based system design and to point out the main differences between agent-based and centralized BP management approaches.

**Key words:** Agent Based Business Process Management.

## INTRODUCTION

The purpose of BPM systems is to automate manual work, improve information exchange among employees involved in the business processes, control existing business processes and to assist the implementation of business process reengineering. Current BPMS are ideal for managing business processes which are well structured and where all logical paths can be fully predefined [1][5][8]. However, not every business process is like this. And the business environment is becoming more dynamic and volatile, and follows more complex processes. The existing BPMS have a number of drawbacks and limitations [5][7][8]. They need improvement and changes. Therefore new approaches, which although include agent-based technologies, are rapidly emerging. The main advantages of the agent - based approach over more traditional counterparts such as management information systems, workflow management, and enterprise integration are that it offers greater flexibility, agility, and adaptability.

Many research teams have introduced their own solution of the BPMS systems using agent technology [2][3][4][5][7]. There are various approaches; each has its own particular enhancements and features of using the autonomous, collaborative and intelligent software agents with agent-based system.

The purpose of the paper is to describe the key concepts of the agent-based system design and to point out the main differences between agent-based and centralized BP management approaches.

The paper is divided into three parts. The first part introduces the key definitions of the BP management. The second part gives the structure of the existing centralized BPMS, while third part describes an agent-based approach. At the end examples of the most known agent-based BPM systems are given.

## 1. BUSINESS PROCESS MANAGEMENT

There are two general concepts concerning business process management that should be mentioned here.

The first one is a business process which is defined as a set of linked procedures or activities which collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles and relationships [8]. Business process management includes following activities over the business process [5]:

Firstly, one should define business process. Process should be described in some specification language, which includes the activities that need to be performed, the participants who could or should perform them, and the interdependencies that exist between these activities.

Secondly, the business process needs to be executed and managed. Organization can use a software system that is capable of ensuring that the process description is realized in practice. This system must: allow the manual activities to be assigned

appropriately, provide access to the software tools required to complete the tasks and ensure that dependencies between the tasks are satisfied. Moreover, the software system should transparently support multiple instances of a given process and a given task.

By introducing a software system for business process management we are faced with the second important notion of the business process management – a workflow. In [8] a workflow is defined as the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules defined as workflow. So the workflow can be any business process, which consists of two or more tasks performed in serial or concurrently by two or more people.

Workflow should assure that the right people receive the right information at the right time. Workflow provides the following general information about the business process:

- Individuals and teams needed to complete task
- Information and resources needed to complete task
- Dependencies and deadlines for task completion.

## **2. INFORMATION SYSTEM FOR BUSINESS PROCESS MANAGEMENT**

Information system for business process management is a system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which are able to interpret the process definition, interact with workflow participants and, where required, invoke the use of information technology tools and applications [8].

Such systems typically consist of the following components [7] (see Figure 1): business process definition tools, business process servers, business process client applications and business process monitoring and administration tools.

Business process definition tools allow you to define and map out the business process in the computer. The formalized build time business process, represented as a coordinated (parallel and/or serial) set of tasks that are connected for a common goal.

Business process servers are the programs providing the run time execution of defined processes. They read the process definition and actually execute and track them.

Business process client application is a software that the business participant uses to interact with the workflow. The software does not need to be part of the business process management system.

### **2.1. Disadvantages of the majority of existing systems for business process management**

According to [8] the majority of current generation BPMS start modeling business process from activity analysis. These systems pay primary attention to business process tasks interdependences, namely, to the enactment sequence of the tasks. Existing systems provide central workflow engine for business process analysis and management, which monitors all events in the system. Such systems can be adequate only in situations where a business process is fully resourced and every conceivable outcome can be considered and controlled.

Unfortunately, as it has been mentioned before, not all business processes can be defined unambiguously. The real world business is a complex, continuously changing environment, so it is hard for centralized BPM systems to reflect real world changes adequately. Because of that described BPMS structure suffers from a number of drawbacks and limitations, including:

- Limited flexibility during process enactment [5]
- Inability to cope with dynamic changes in resource levels and task availability, as existing systems tend to lack the necessary facilities to redistribute work items automatically as and when required [7].

- Inadequate exception handling, especially during the processing of decomposed items [7].
- Limited ability to predict changes, due to external events, in both the volume and composition of work [7].
- Incompatibility of the components of the systems. Majority of existing BPMS consists of comparatively independent subsystems, which can hardly be linked to each other.
- Poor system accessibility and usability by the users.
- Inadequate representation of the real world business process that makes it difficult for users to work with this system (especially for BP participants that are not involved in the system maintenance), that in their turn leads to situation, when the system is not used by the users, that just wider the gap between real world process and it's computer representation.
- Usually lack of performance, scalability and reliability [7].

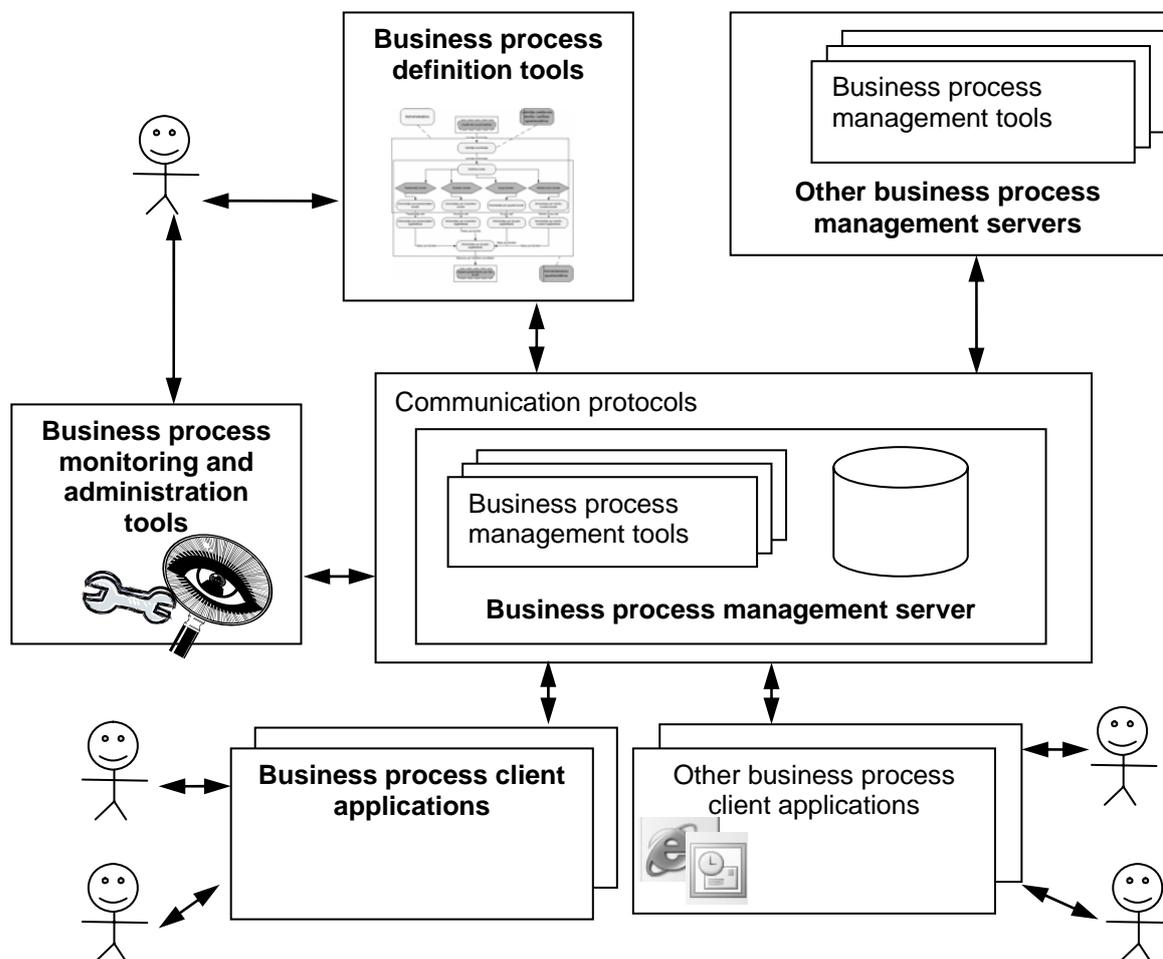


Figure 1. Conceptual model of centralized business process management system [7]

### 3. AGENT-BASED BUSINESS PROCESS MANAGEMENT SYSTEM

One of the possible decisions to eliminate the drawbacks of the existing (not agent-oriented) business process management systems is to involve agent technologies in coordination of business processes.

An agent based business process management system is a set of software components that meet the criteria to be considered as agents and are involved in managing the flow of work through a business process [7]. The idea of the agent-based

BP management systems is to split business process into parts and trust the control over such part to individual software agents (see Figure 2).

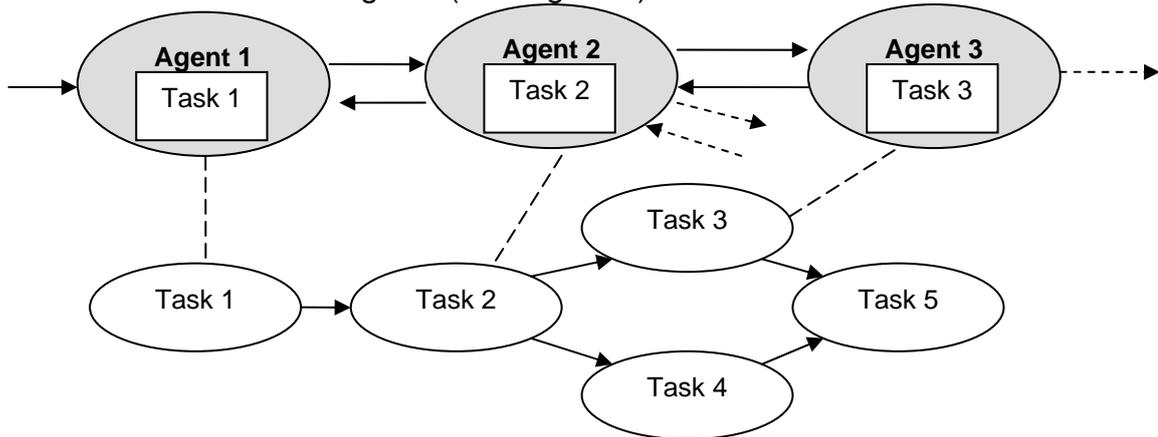


Figure 2. Agent-oriented business process

Agent-based approach allows to split business process into groups in order to commit the coordination of this process groups to autonomous or semiautonomous software agent. Business logic, explicitly defined to agent by some set of business roles, is intended to show agent's task and resource dependencies from other business process participants, which usually although are agents. Agents use business logic to plan their activities in order to achieve goal of the concrete process participant. Communication protocols are implemented in order to allow agent to synchronize their actions.

Conceptual model of the agent-based BPMS is shown on Figure 3. Knowledge about the business process logic is distributed among participants of the process. Each agent acts according to his user goal, provides actual information about participant's current tasks and deadlines. Intelligent agents should be possible to plan their actions, make searches for achievements of alternative goal solution parts, explain own actions to the user and make advices.

### 3.1. Advantages of the agent-based business process management systems

Here the authors sum up the main advantages of usage of an agent based business process management [1], [5]:

- The use of goal oriented, communicating autonomous agents, which although concerns about business logic, allows multiple solution paths to the business process goal to be achieved.
- Agent - based technologies allows greater flexibility and dynamism in the business process management system. Decoupling components of the system allows them to be swapped out, replaced, or even added to the system without impacting other parts [1]
- Allows decentralized ownership of the tasks, information and resources involved in the business process.
- Agent-based systems provide access to the system, even if the system is physically distributed. They allow to build highly decentralized, distributed systems, which corresponds to the real world situation, when the business processes in organizations are physically distributed (this distribution may be across one site, across a country, or even across continents).
- The use of autonomous agents provides high degree of natural concurrency, when many interrelated tasks are running at any given point of the business process.

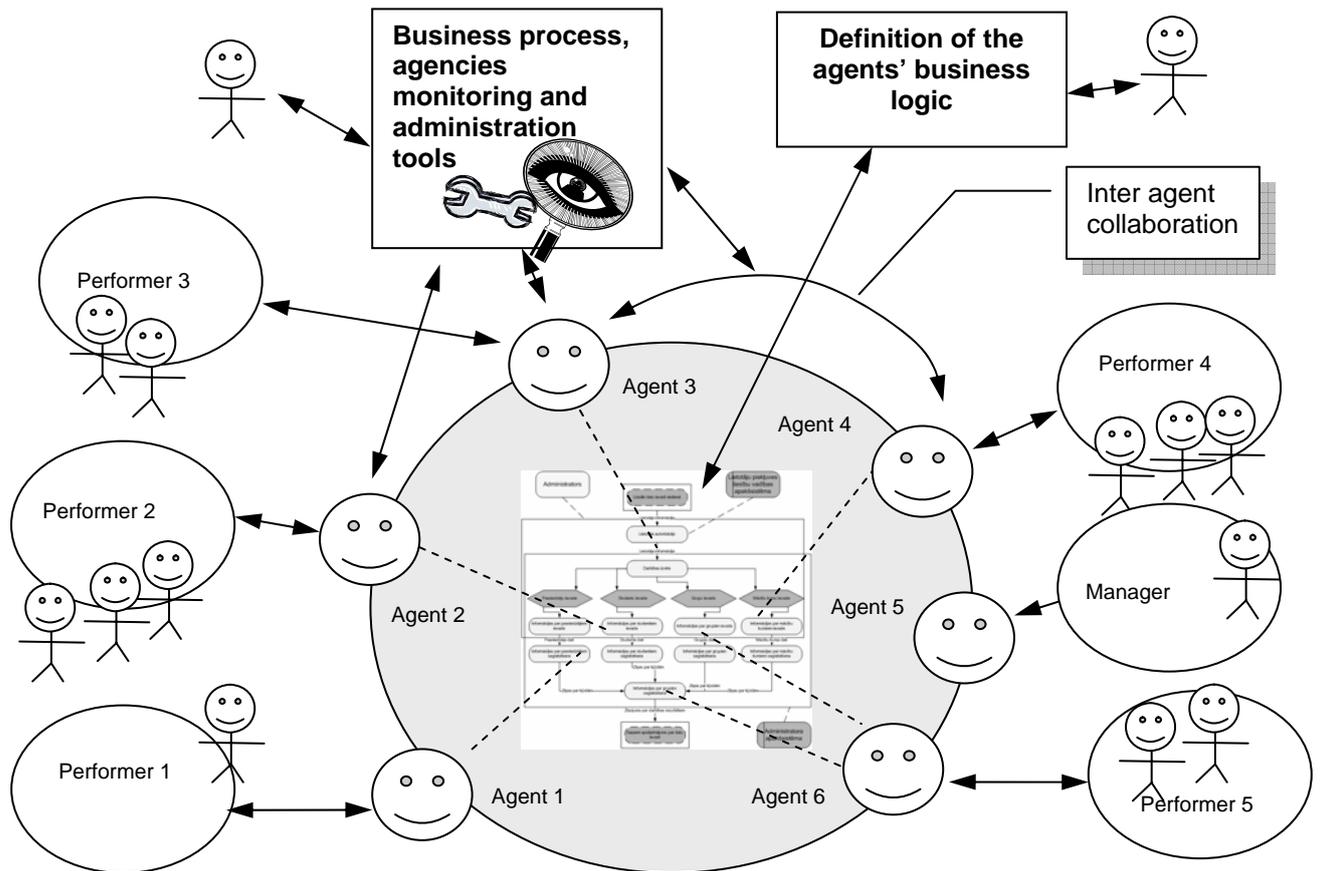


Figure 3. Conceptual model of agent-based business process management system

### 3.2. Disadvantages of the agent based business process management systems

As mentioned in [6] the very nature of the agent paradigm leads to a number of problems, common to all agent - based applications:

- The agent-based systems have no overall system controller. It means that agent-based solution is not the best choice for managing business processes with a lot of global constrained to be maintained. Agent – based solution is not appropriate for domains in which global constraints have to be maintained, in domains where a real-time response must be guaranteed, or in domains in which deadlocks must be avoided.
- Agent-based systems have no global perspective. An agent's actions are, by definition, determined by that agent's local state. However, since in almost any realistic agent system, complete global knowledge is not a possibility, this may mean that agents make globally sub-optimal decisions. This is one of the main issues that the agent-based business process systems managers should take care of.
- Users of the agent-based system usually face with trust and delegation problem. For individuals to be comfortable with the idea of delegating tasks to agents, they must first trust them. Users have to gain confidence in the agents that work on their behalf, and this process can take time.

### 3.3. Implementations of the agent-based business process management systems

Agent based workflow systems have been developed by a number of teams, each offering their own particular enhancements and features. The Advanced Decision Environment for Process Tasks (ADEPT) [5] is one of the first agent based workflow systems that was developed at British Telecom for its real business process. The ADEPT

system consists of multiple software agents which negotiate concurrently with each other in order to reach agreement on how resources are to be assigned to support a business process. The agents take full responsibility for business process provisioning, execution and compensation, with each agent managing and controlling a given task or a set of tasks. Other systems such DartFlow BPMS [2], TRP (Technology Reinvestment Project) project support environment [4], RSA BPMS [3] etc. introduces their own agent-based approaches for BPM.

### **CONCLUSIONS AND FUTURE WORK**

This paper looks through general theoretical questions about agent-based business process management. It gives overview of the main concepts of BPM and figures general conceptual model of the centralized and agent-based BPMS. Paper points out key properties of agent-based BPMS, sums up main advantages and disadvantages of such systems. Paper doesn't pay attention to implementation problem of the systems.

The existing agent-based BPMS solutions, that have already been developed and applied as the solution of the real world problems, proves that the agent technologies is a highly perspective direction for future researches. The main issues which the designer of an agent-based BPMS should be aware of are: inter agent communication protocols, agent action planning (which is itself a topic for future researches), business logic representation problems.

Authors' future work is concerned with the development of design of the agent-based information system for administrative documentation management of the academic projects of Riga Technical University (RTU).

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