

# Agent-Oriented Enterprise Architecture: new approach for Enterprise Architecture

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## Abstract

Nowadays, utilizing EA by enterprises with medium and long term goals causes improvement in their productivity and competitiveness. With respect to varied changes in enterprise's business activities and attitudes, flexibility in information systems of EA is a crucial factor. Agent's capacities in implementation of complex systems goal convince huge enterprises to use agent oriented architecture in their EA programs. Combination of EA and agent oriented architecture introduces a new attitude in order to make a better conditions for huge enterprises with complex information systems.

This paper firstly enumerates the current problems of Enterprise Architecture, and then agent-oriented Enterprise Architecture is introduced as a comprehensive solution for eliminating mentioned defects deals raised. The main results of agent-oriented Enterprise Architecture includes: more flexibility in organizational change, reengineering organizational processes and comprehensive coverage of all activities of huge and complex organizations with no other lateral requirements.

**Keywords:** *Agent-Oriented Enterprise Architecture; Enterprise Architecture; Agent Architecture*

## 1. Introduction

Enterprise architecture is a new approach to aligning business and IT within an organization for competitiveness. Enterprise Architecture is a comprehensive system that encompasses all activities aspects of an organization [12]. The exact and specific relationship among the components of the organization's architecture is an Enterprise Architecture's advantage, which is implemented by the Enterprise Architecture's program. In other words, the duty of enterprise architecture is to implement the enterprise architecture's structure in an

organization. Comprehensive coverage of an organization's activities, causes enterprise architecture structure seems complex and ambiguous, so to avoid problems and to identify a suitable model, existence of a framework in enterprise architecture is vital. Utilizing a suitable framework facilitates the analysis of organization structure in order to determine the current status, optimal conditions and also defining the transfer functions [2][13].

Different attitudes in enterprise architecture are established since EA is introduced by John Zachman. After a while, the framework provided by Zachman was separated into more specialized framework such as federal, financial and military. Each of these frameworks has the capability to cover the organization's activities in their own professional field. Combination of Service Oriented Architecture, Enterprise Architecture and Agile Architecture creates Enterprise Architecture based on services and Agile Enterprise Architecture. All these efforts were made to augment EA and increase success rate of EA's programs in an organization.

Since software architecture has a very constructive role in the successful implementation of enterprise architecture, so it's vital to utilize the new software architecture for the enterprise architecture which has already been tried by service-oriented architecture and Agile Architecture. Nowadays Agent-oriented architecture which has obtained its own special place in all software's aspects including analysis, design and implement, can obtain great success in projects with huge and complex structure [2][5][6].

## 2. Agent-Oriented Architecture

Agent-oriented architecture is formed based on the fact 'agent', which has the capability of autonomy in decision making, team work, work passively and being goal oriented.

These characteristics form the software operate dynamically and make appropriate decisions based on common interaction with each other in case of each event and then take appropriate reaction. Some agent-based system's applications are as follows:

- Solving problems that are inherently large and complex and requires a distributed mechanism for resolving them.
- Reduce processing costs (utilizing a large numbers of inexpensive processors is better than an expensive and powerful ones).
- To provide interactive between Legacies Legacy systems.
- Applications where their focus is on scalability.
- Providing solutions for problems that are inherently distributed. For example: Workflow Management, air Traffic Control

As it is obvious in agent definition an agent has the ability to perform an activity encapsulated in a flexible and independent environment in order to fulfill design goals. The environment is a place where the agents interact with each other and resolve operational and information requirements of each other's [7][8].

## 3. Existing Enterprise Architecture Problems

Most organizations during implementation enterprise architecture are faced with below problems [2]:

- Deflected and scattered focuses
- Project teams, are not familiar with existing enterprise architecture.
- Project teams; do not follow the enterprise architecture.
- Project teams; do not cooperate with the enterprise architects.
- The architectures are obsolete old
- Less attention to architectural models
- Non-routine programs
- The tendency to do all this extra work just because it is good for the organization.

There are various theories for software development and each of them has been tested. The important point to mention is that agent-oriented architecture has the

capability to solve all these problems. Agent-oriented architecture can deal with obstacles and solved problems from the beginning to the end of a project by defining agents as independent elements with ability to perform proper interaction with each other. The agent-oriented architecture has capabilities to focus on the business architecture.

## 4. Proposed Approach

By considering these points:

- The agents are the existence of solutions that have well-defined intervals.
- Agents operate in special environments and sense inputs of the environment's state through their sensors and operate on that environment by their effectors.
- Agents are designed for specific roles.
- Agents are independent and have control over the interior situation and their own behavior.
- Agents are able to provide flexible solution. It is necessary to be reactive to what happens in the environment surrounding, which helps them achieve their goals. It is necessary to have very active agents in order to get initial values and data to fulfill new goals.

Agent-oriented architecture has capabilities to solve current problems of enterprise architecture by its characteristics [7][8].

### 4.1 Why Agent-Oriented?

As EA makes a revolution in business and information of an enterprise, so it's vital to utilize an appropriate method in order to reduce complexity and manage this complex organization better. In this part the reasons are stated that why agent oriented architecture is a solution for EA's problems.

- Agent-oriented analysis is an appropriate method to divide the problem in complex systems.
- The main agent oriented abstracts is a useful tool in modeling complex systems.
- Agent oriented viewpoint is appropriate for detection and communication management of the organization .it is suitable for dependency management and the interaction, exists in a complex system.

For example, if financial sub-system faces changes due to tax and legal laws, in a centralized and complex system all other sub-systems are affected and in many cases cause improper behavior in system. If the system is formed based on agent oriented capabilities, these kinds of

problems rarely occurs, and active agents reconstruct overall system structure by means of defined structure automatically or in team activities. The system can overcome the problems of non-pre-defined changes, by its dynamic structure [4].

#### 4.2 Agent-Oriented Enterprise Architecture

In the complex system, relations between systems components are changed continuously, thus they require a set of components to acts as a conceptual unit when they are observed at different levels of abstraction. This view is quite compatible with experience of agent oriented viewpoints, by this definition it's obvious that facilities are provided for clear organizational communication.

There are various types of organizational communication in complex systems which are important for two reasons: First, a number of separate components can form a group together, secondly, they make it possible to fully explain the existence of high levels connections and defined their details (Figure 1) [9].

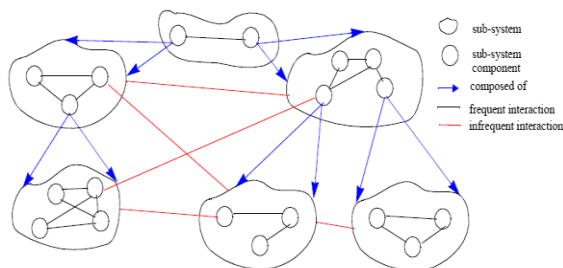


Fig.1 sample of complexity structure in complexity systems

The effect of organizational communication and structures on systems' behavior, illustrate the importance of a flexible management .these communication are continuously changing and ability to adapt dynamically to new circumstances is often necessary. As it was mentioned before the first entity are the existence in agent oriented systems. So clear structures and flexible mechanisms of are the centrality of agent oriented patterns.

If this ability is combined with computing mechanism ,it would enable agent oriented systems to change according to their requirements and also, make many middle forms which are necessary to produce complex systems more rapidly. This means that agents or organizational groups can be produced relatively independent of each other, and this would ensure appropriate growth and proper coordination.

When the project teams works with assumption that they can do anything they want, and utilize any technology to make change in results, the result is that the works and data

are duplicated and reusing them rarely happens. Systems won't work properly and they are incompatible with each other and cause each other to fail and increase costs dramatically.

A bad reality that exists is that almost a few number of software systems operate in a close environment while they should communicate with several and sometimes hundred other systems. In an organization, application must be effectively cooperate with other systems, as a result the application must be developed a little in order to prevent harmful effects on other systems .also they should be produced ideally to take advantage of systems and increase shared infrastructure. Each system must be constructed so it can fit in the existing environment of an organization, and it's better to represents future viewpoint in it. Such information should be registered in the enterprise architecture, current and future models in respect. The purpose of agent oriented EA is to ensure proper implementation of activities and providing dynamic structure in implemented system .to sum up agent oriented EA is result oriented and make the activities successful by utilizing clear definition of an agent's goals and providing an appropriate environment.

Agent oriented enterprise architecture is a method to define all aspects and different viewpoints of a busy and complex organization where unpredictable change in mission and technology are thoroughly impressive. These changes are unpredictable so the organization has not the ability to create and develop a specific plan to deal with them. Thus, agent-oriented enterprise architecture is capable to define organization's current situation and desire state by means of agent-oriented models, techniques and methods. Formulation and implementation of transfer pattern is one of enterprise architecture principles and is planned well in agent-oriented enterprise architecture.

According to Agents abilities such as autonomy and interaction they can capable to cover all aspect of Enterprise Architecture. For reaching to this purpose define some items as well are very important (figure 2). Those items are [9]:

- Defining accurate information/activity environment
- Determining accurate relation between enterprise systems (inter systems)
- Determining accurate performance and interaction between agents
- Determining accurate agent activities domain

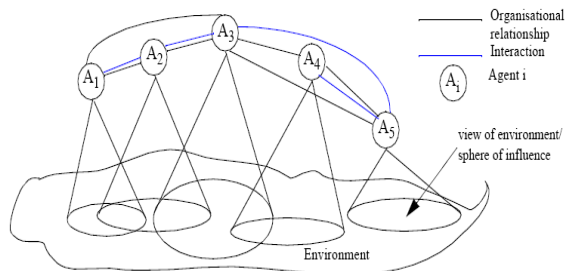


Fig 2 Focal vision of multi agent system

## 5. Conclusions

Utilizing agent-oriented enterprise architecture is appropriate for organizations with complex missions and where missions are highly dependent on each other. Generally, by means of agent-oriented architecture's patterns, in Enterprise Architecture, an organization will be able to perform the following:

- Increasing the likelihood of successful implementation of Enterprise Architecture
- Changes in the organization's plans
- Increase competitiveness against other organizations.
- Development of the lateral structures through proper implementation of Enterprise Architecture
- Development of long term and medium term organizational goals
- The development of enterprise data structures
- Stability in the development of enterprise plans

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