IT Governance: Integration of Multi Agents Systems in the framework ITIL's Processes

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Abstract— The construction of a strategic vision of the relation between the governance of the organization and the information system has became a constant of the concerns of the management of information systems, which positions as a contributor in the global performance of the company today. Given the importance of the interaction, coordination and collaboration in information systems, we are required to establish a solution to answer to these indispensable requirements for the proper functioning of the information system governance, using expert system which is composed of several multi agents systems.

In this paper, we present the expert systems and multi-agents systems approach as well the characteristics inherent to the agents, namely: the interaction, the intelligence, the coordination and the communication, and their importance in the structure of the processes of the framework of governance ITIL.

*Index Terms— **IT Governance, ITIL, Multi Agent System, Expert System, Distributed System.***

I. INTRODUCTION

The domain of IT Management focuses on the efficient and effective supply of IT services and products, and the management of IT operations. IT Governance [1] is mostly concerned setting the goals and objectives for metting present and future business challenges.

In ITIL [2] [3], the quality of service is based on a structuring of activities of the interdependent, measurable processes and which can be repeated. This approach of management of the activities by process is recognized today like most effective by a large number of companies. ITIL adopted this solution by cutting out the management of the services data-processing in several processes. This cutting is a recommendation and can be adapted to the needs for each company.

A common point of the governance IT and the Multi-agent system (MAS) is management by process, indeed this way of managing prepares perfectly with the governance of IT which is not other than a set of processes which interact between them for a better management of information technologies.

The paper contains the following parts: After the abstract and a brief introduction, we talk about fundamental aspects of the framework ITIL and multi-agents systems, we present next expert systems. Then we describe the proposed solution, finally conclusion and perspectives for this work.

II. ITIL AND MULTI AGENTS SYSTEMS

A. Presentation of ITIL

The use of computers has become essential for business organizations. Having the best technology will not guarantee the expected needed service reliability. It is necessary for them to have a full service around these technologies. There is a large number of repositories that reflect the best practices developed over the years, ITIL presents a guide of best applicable practices suitable to all types of organizations providing services to a business organization [4]. ITIL shows the framework of the organization, objectives, processes related to major activities of information services and their interactions. It is a kind of canvas that can be used by the directions of information systems to design their own organization.

The IT Service Management ITIL is based on five groups of activities (each containing its multiple processes) to manage the service throughout its life cycle [5]; ITIL recommends taking into account management of services, from the phases of study and defining the needs of IT projects. This, provides several benefits to all teams of the production or development, but serves primarily to provide a more reliable service to the customer, it also validates that we have many resources and skills necessary for the operation of this new application, which involves taking into account the impact on physical infrastructure in areas such as capacity, performance, availability, reliability and maintenance. The five phases are:

- Service Strategy: The phase of strategic planning of service management capabilities, and the alignment of service and business strategies.
- Service Design: The phase of designing and developing appropriate IT services, including architecture, processes, policy and documents; the design goal is to meet the current and future business requirements.
- Service Transition: The phase of realizing the requirements from previous stages, and improving the capabilities for the transition of new and modified services to production.
- Service Operation: The phase of achieving effectiveness and efficiency in providing and supporting services in order to ensure value for the customer and the service provider.
- Continual Service Improvement: The phase of creating and maintaining the value for the customer

by design improvement, and service introduction and operation

In the ITIL framework, the quality of service is based on a structure of measurable possible repeated activities in interrelated processes. This approach to service management by process is now recognized as the most effective by a large number of companies. The implementation of processes providing efficient operation of these systems is therefore an important element to enable businesses to take full advantage of their entire IT infrastructure.

A process consists of several activities generating results to clients. It is called after a trigger event. A well-studied process must achieve the objectives, using optimal time, money and resources. A process is provided by roles and not directly by the people, what makes this notion generic and independent of the organization.

B. Challenges of ITIL adoption and Proposition of multi-agent solution

Despite the flexibility of ITIL [6] [7] and its processes, organizations are faced with many challenges when adopting ITIL best practices that can lead to increased complexity. The inability to control this complexity leads to increased costs and longer time lines for implementation. Such as:

- Lack of management commitment: it presents the main cause of the failure of the implementation of ITIL because without it nothing tends to occur.
- Choosing an inefficient point of departure: for the adoption of ITIL there is not a standard starting point, every business must start with a gap analysis between existing and ITIL benefits to be able to find areas where organization will receive more value by adopting ITIL.
- Resistance to ITIL: ITIL is a major organizational change which is always resisted. Departments, teams and individuals tend to defend the current status.
- The close relationship between activities of different processes.

C. Definition of Multi Agent Systems

What is an agent?

An agent is an entity (physical or abstract), autonomous in decision making, by his knowledge of itself and others, and its ability to act [8]. Experts multi-agent systems have classified agents into three major categories according to essential criteria that is the representation of its environment, and are therefore: Reagent agents, Cognitive agents and Hybrid agents.

What is a multi agent system?

A multi-agent system is a distributed system consisting of a independent agents, each with their own thread, specific to fulfill goals, and ways to communicate and negotiate with other to accomplish their goal [9][10]. Multi agents system is composed of the following elements:

- An environment with a metric in general
- A set of objects, which can associate a position in an environment in a given time. Agents can perceive, create, destroy and modify these objects.
- A set of agents, which represent the active entities of the system,
- A set of relationships between agents between them;

D. Proprieties and advantages of the MAS

Multi-agent systems (MAS) are systems where multiple agents can interact with each other in various modes including cooperation, competition or mutual existence [11] and enjoys the following properties [12]:

- Autonomy: agents operate without the direct intervention of humans or others, and have some kind of control over their actions and internal state;
- Social ability : agents interact with other agents (and possibly humans) via some kind of agent-communication language;
- Reactivity: agents perceive their environment and respond in a timely fashion to changes that occur in it;
- Pro-activeness: agents do not simply act in response to their environment; they are able to exhibit goal-directed behavior by taking initiative.

The need for autonomy makes the agent support activities in an intelligent and flexible way and can adapt to the environment without requiring human intervention [13].

Some advantages of using multi-agents systems [14] compared to other technologies:

- Scalability and flexibility; it is easy to add new agents to the system.
- The development and reusability, since it is easier to develop and maintain modular software.
- Robustness and reliability.

III. EXPERT SYSTEMS

Who is an expert?

The experts [15] who participate in the ontology process are allowed to use their own terminology, facilitating knowledge integrations with cooperative tools.

What is an Expert system?

Expert systems (ES) [16] are a branch of applied artificial intelligence (AI), and were developed by the AI community in the mid-1960s. The basic idea behind ES is simply that expertise, which is the vast body of task-specific knowledge, is transferred from a human to a computer.

An expert system [17] can assist decision making by asking relevant questions and explaining the reasons for adopting certain actions. Expert systems of representing knowledge include knowledge base, rule-based systems, knowledge frames, expert system shell, inference engine, and case-based reasoning. Sometimes, expert systems [18] are integrated with other AI methods, such as neural networks, fuzzy logic, genetic algorithms, and intelligent agent, using their functions of automated reasoning and machine learning.

Components of Expert Systems

The basic components of the expert system [19] are:

- Knowledge Base: The knowledge base is the repository for the domain knowledge used by the system in the form of rules. The knowledge base may also contain long term historical information and facts.

- Inference Engine: The inference engine operates on the context, utilizing the rules in the knowledge base to deduce new facts which then can be used for subsequent inferences.
- User interface: This is the system that allows a non-expert user to query (question) the expert system, and to receive advice. The user-interface is designed to be a simple to use as possible.

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Fig. 1. The basic architecture for an expert system

Characteristics of Expert Systems

- High performance: They should perform at the level of a human expert.
- Adequate response time: They should have the ability to respond in a reasonable amount of time. Time is crucial especially for real time systems.
- Reliability: They must be reliable and should not crash.
- Understandable: They should not be a black box instead it should be able explain the steps of the reasoning process. It should justify its conclusions in the same way a human expert explains why he arrived at particular conclusion.

Advantages of Expert Systems

- Availability: Expert systems are available easily due to mass production software.
- Cheaper: The cost of providing expertise is not expensive.
- Permanence: The knowledge will last long indefinitely.
- Multiple expertise's: It can be designed to have knowledge of many experts.
- Explanation: They are capable of explaining in detail the reasoning that led to a conclusion.
- Fast response: They can respond at great speed due to the inherent advantages of computers over humans.

- Unemotional and response at all times: Unlike humans, they do not get tense, fatigue or panic and work steadily during emergency situations.

IV. THE PROBLEMATIC

A. ITIL process communication

One of the interests of ITIL [20] is to define a common language to the users, the customers and of course to the members of the data-processing direction. This language defines the terms used in the annual reports and the contracts of service (SLA) and in general in all the documents used jointly by the data-processing direction and the other management of the firm.

Many activities imply a regular communication between the Directorates trade and the computer department. A good communication is an important component of the quality of the service. Nevertheless, the economic environment of the company does not authorize waste of time. Tended flows, the reduction of the deadlines are as many constraints as the company must assume to survive. However, even if the computer department is not excluded from this situation, this race against the clock should not be done to the detriment of the communication when time and the resources are limited.

However, it is not a simple task and the direction can be confronted with specific regulations of industry from where importance of use of tools software to increase its chances to be effective and efficient.

In the continuation of this paper we suggest a solution containing the expert system and the multi-agents systems to allow the various processes to communicate between them.
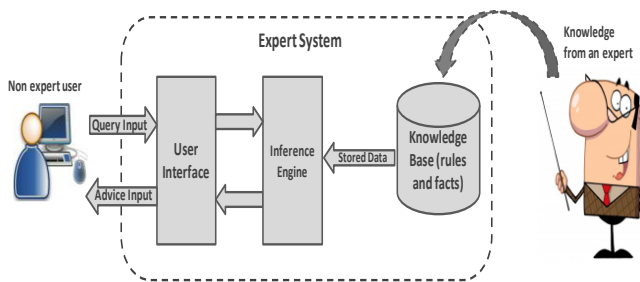
V. OVERVIEW OF THE PROPOSED ARCHITECTURE

Before describing our architecture, we will speak about the environment where it will be implemented, however, we are going to integrate our architecture at first into a global platform; in the context of a search for our team of the LASER laboratory; which includes the several methodologies, standards, frameworks and good practices for IT GRC [21] and afterward our architecture will be generic and easy to adapt in PMI-PME which base themselves on the best practices of ITIL.

The diversity of frameworks raises a strategic difficulty for companies to choose the adequate IT GRC frameworks' regarding top management choice As a result, this IT-GRC platform architecture able to distribute the majority of system's functionalities into processes. It focuses on business objectives and proposes the best solution for an efficient IT management. To gain a deeper understanding of the proposed architecture, we describe each layer of the IT GRC platform:

- Strategic Layer: based on COBIT framework. It contains an interactive level in an intelligent way to specify the IT needs following the strategic directives, based on multi-agents systems.

- Decision Layer: propose the best reference tables based on multi-agents systems.
- Communication Layer: It is responsible for all communications between layers of the IT GRC platform, based on MAS.
- Processing Layer: This layer contains different systems, which can be implemented, responding to communication layer's alert. Systems included in this layer are: ITIL, ISO27001/ISO27002, PMP, MEHARI, EBIOS and others.
- Updater: update all the knowledge bases of various parts of the IT GRC platform
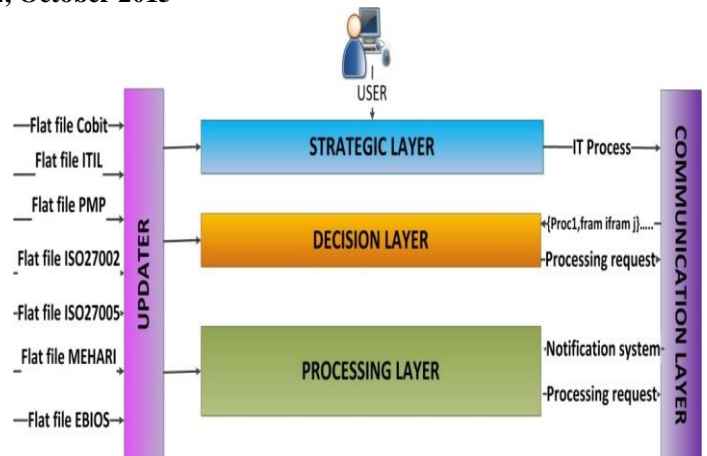

Fig. 2. IT GRC Architecture

VI. OUR PROPOSED ARCHITECTURE

In a first phase we will develop a solution MAS [22] based on the framework ITIL which answers the requirements and the objectives of the permanent improvement of the services:

- To reach the levels of service;
- To improve quality of service;
- To improve the effectiveness and efficiency of the processes;
- To improve the cost of the supply of the services without sacrificing the satisfaction of the users.
- The Platform MAS will be an invaluable asset to store, manage and share information. It will gather four categories of tools: communication and transformation, control, numerical models, intelligence and autonomy of the multi-agents systems used.

A. Description of the architecture

- In a first place we will integrate an expert system and multi-agent systems in different domains, Process and roles of the framework ITIL, like it shows it in **figure 3.**

This integration engenders the following scenario:

- Expert system: Our expert system is based on the data collection of rules and analysis of the environment by the agents whom they can look at to make decisions. Its knowledge base contains the best practices of ITIL that are updated by the updater as shown in **figure 3**.
- The expert system take the parameters of environment and the IT process as to input enter, the first step is to identify the problem to be solved and the characteristics of the solution, the second step is synthesizing feedback with various combinations of diagnostic, interpretative and predictive curriculum, in the last step the expert system can choose the domain of ITIL, the responsible processes as well as their roles and the user who will execute this demand (request).
- MAS Analyze phase: Contains the five various domains of the framework ITIL, in these domains we integrated a multi-agent system to manage it and be attuned to execute the demand (request) of the expert system.
- MAS Analyze Process: Contains the various responsible agents on the processes of ITIL's.
- MAS Roles: Contains the responsible agent's roles of the processes of ITIL.
- MAS Users: He indicates the user who is going to execute the demand (request).
- MAS Performance Indicators.

The modeling of the platform is based on the principle of the MAS which is: everyone must cooperate to achieve the same goal. For this reason architecture is made up of a set of Agents of various types which communicate and cooperate between them in an intelligent way [18]. It is an agent of type the cognitive or intelligent thanks to its competence which it has to communicate, intervene and control other agents with knowing the agent phase and the agent Process. In this case the expert system can be used as a decision-making tool.

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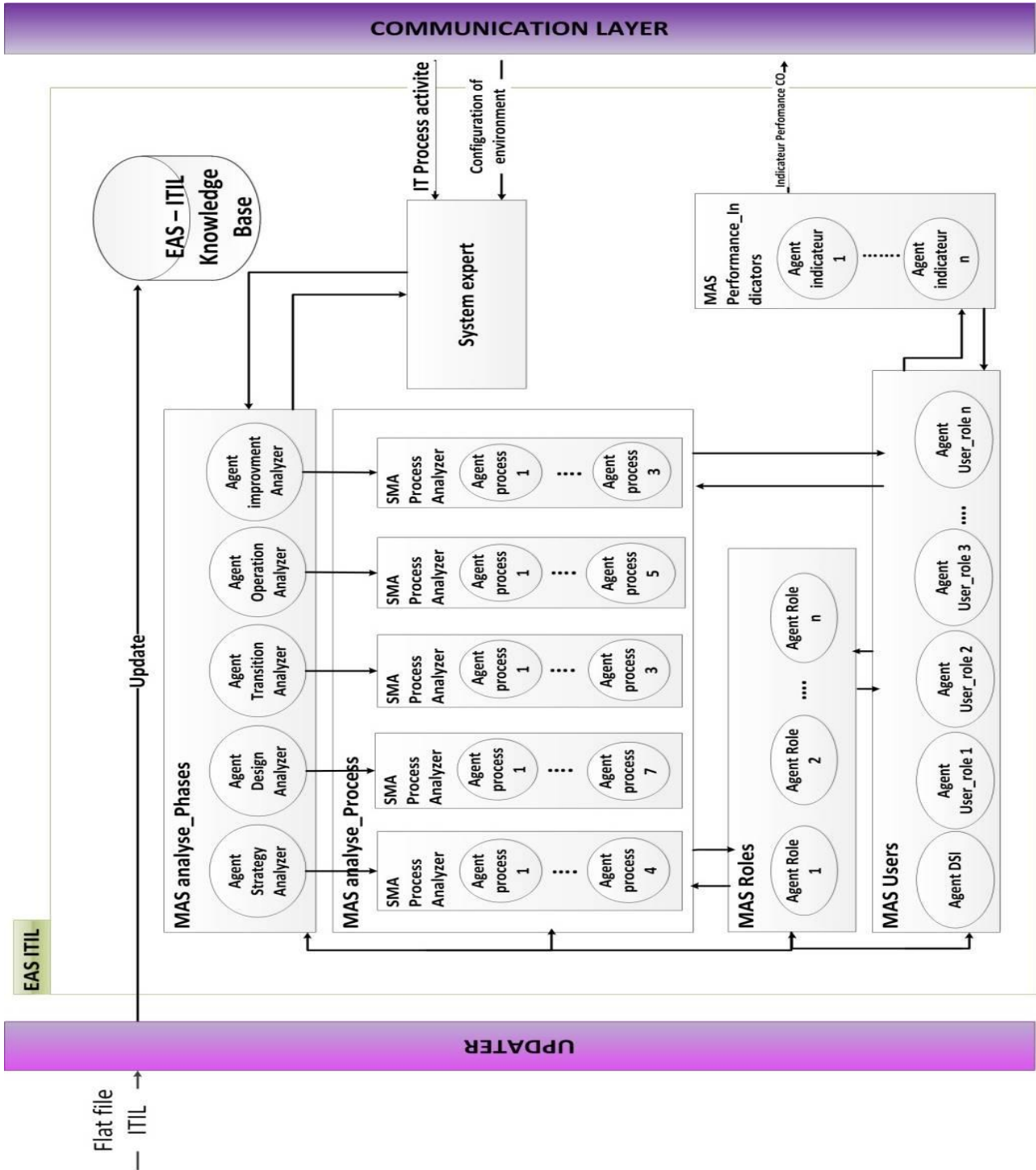
VII. CONCLUSION

In this paper, we illustrated the design of our architecture EAS-ITIL which has the objective to help IT managers to choose the right processes and roles to comply with their information systems.

The particularity of our approach is using both: expert systems and multi agent systems [23] that add intelligence to our solution. This solution will facilitate the communication between the various processes and will thus answer the requirements and the objectives of the permanent improvement of the services. We will present in a next works an implementation with UML language [24] [25] of this architecture and achieve. Future works consists on proposing communication architecture based on passing message between agents of the system, in order to compare the both proposition and implementing the best proposed model in order to overcomes obstacles and achieve IT organization objectives.

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