A CONCEPT FOR A SMART WEB PORTAL DEVELOPMENT IN INTELLIGENCE INFORMATION SYSTEM BASED ON SOA

Jugoslav Achkoski
Military Academy
"General Mihailo Apostolski"
Skopje, Macedonia

Vladimir Trajkovik
Faculty of Computer Science
and Engineering
Skopje, Macedonia

Nevena Serafimova
Military Academy
"General Mihailo Apostolski"
Skopje, Macedonia

ABSTRACT

This paper presents a concept for Service Oriented Architecture (SOA) approach in a prototype of an Intelligence Information System (IIS). IIS prototype, based on SOA, could offer better coordination among institutions involved in intelligence thus providing increase of intelligence effectiveness. This approach can serve as a foundation for the establishment of the Integrated Intelligence System, which is based on services as software components.

Here, our main interest is the upgrading of the Intelligence Information System with a Smart Web Portal, composed of three modules combined together to automate the Intelligence Cycle. The purpose of this feature is to serve as a platform for integrating Intelligence's information collected by different sources and ensure information delivery to the right end-user.

I. INTRODUCTION

Intelligence, as a public service, has a great significance for a country. Frequently used information systems which support intelligence activities, have high influence in the decision making process. Modern information technology considerably contributes to the improvement of the processes by supporting intelligence cycles (planning, collecting data, analyzing data and dissemination). In spite of the constant improvement in the field of information technology, the field of intelligence has not witnessed significant quality advancements during the past ten years [1].

In this context, SOA offers new opportunities for an increased efficiency of IIS. These opportunities could be found in the form of expanded solutions for designing intelligence and information systems [2], [3]. The SOA approach in the information systems is a logical solution, not only for temporary and short term exploitation, but also as a perspective solution for general strategy in companies and governmental institutions [4].

Every modern intelligence system is based upon some type of information system. Usage of contemporary technology, especially Information Communication Technology (ICT), leads to a more efficient execution in all of the intelligence service's phases.

Intelligent information systems have software components capable of simulating human Intelligence. These types of systems have capability to observe and track changes which happen in the environment. Depending on the implemented knowledge and heuristic models, they can respond to these changes to a certain extent. The discipline of Artificial Intelligence (AI) deals with constructing intelligent computers capable of solving highly complex tasks, whose abilities can be even competitive to those of a human.

For the purpose of avoiding potential confusion, we will use the adjective "Smart", instead of "Intelligent" for the Web Portal, leaving the similar but semantically different word of "Intelligence" for the discipline engaged with a specific type of product.

This article is divided into several sections. Section III describes the model of Intelligence Information System. In Section IV we discuss a model of a Smart Web Portal for the distributed IIS. Finally, Section V gives some concluding remarks and future work highlights on the issue.

II. RELATED WORK

Web Intelligence has been vastly treated through the literature. Its research field, as proposed by Zhong et al. (2002), encompasses Web information systems environments and foundations, ontological engineering, human-media interaction, Web information management, Web information retrieval, Web agents, Web mining and

farming, and emerging Web-based applications. A need is acknowledged for a deeper understanding of computational, logical, cognitive, physical, and social foundations as well as for technologies that will enable development and application of web-based intelligence and autonomous agents systems.

In the work of Buhler and Vidal [5], a composition language is used for the purpose of creating an agent wrapper which allows services to collaborate.

The Semantic Web Services as presented for example in [6], extend Web technology by enabling interactions between machine and human as well as machine to machine interactions, with well-defined semantics of Web resources and services.

III. Model of Intelligence Information System Based on SOA

The Model of SOA-based Intelligence Information System shown on Figure 1 should completely fulfil the intelligence role and assignments and its connection to the information systems of similar institutions [12].

The presented IIS model encompasses three types of users: service providers, service consumers and Intelligence. Service consumers are institutions (Crisis Management Center, MOI, Intelligence Agency or others) which need information from IIS or can give information as a notification [13].

The intelligence is based on several disciplines: IMINT, SIGINT, MASINT, OSINT, etc. In order to fulfil their requirements, several tasks should be completed; gathering information (assessments, analyses, generating reports, etc.), verification and notification (e.g., political and security situation in foreign countries related to security of investments), etc.

All services are getting information from appropriate service providers through Information systems of the government institutions or the agencies which are included in Intelligence cycle. In addition, it is possible for other Information systems to act as service providers for inter-institutional governance. Service providers which support for the workflow processes, define which web services can be exploited by the users with appropriate service registers' security level.

Our methodology of developing SOA-based Intelligence Information System consists of several postulates. Experiences from recent researches which refers to SOA show that agencies, departments, institutions and other stakeholders can push and pull data on a standardized and flexible manner through communication interfaces using XML schema and web services.

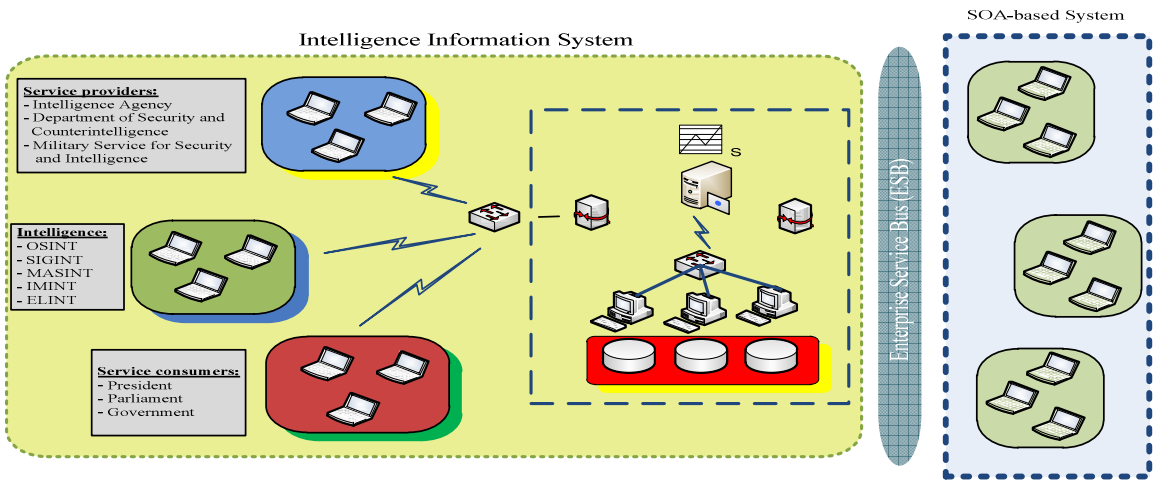

Figure 1: Model of SOA-based Intelligence Information System.

The first postulate defines data exchanging methodology within SOA. It should be compatible with publicly described solutions for information systems which are supporting intelligence functions.

The second postulate focuses on the usage of SOA for information systems design, with the intention of finding relevance for developing Intelligence IIS.

The third postulate describes end users' functionalities for the IIS. Depending on a particular type of user, the functionalities of IIS can be explored from different aspects. Intelligence, being a system end user of IIS, is based upon intelligence disciplines which are further divided to sub-intelligence disciplines.

The fourth postulate provides means that enable the future development of the IIS. In order to meet its future requirements, information infrastructure should be adoptable and flexible, and thus it needs to fully support information sharing process.

The fifth postulate suggests a need for implementation of security standards for achieving adequate security level.

These five postulates promote the SOA system as a most appropriate IT infrastructure for the IIS purposes. Here we have minimum requirements for designing services which are needed in the intelligence process, with internal functions available for processing from external IIS peer [11].

IV. Smart Web Portal Development

The functioning of a comprehensive integrated Intelligence Web Portal should be organized around (but not limited to) collecting, classifying, search of data together with planning, scheduling and finding solutions to specific problems. Each of these operations imposes numerous system requirements and on the other hand, is subjected to substantial constraints. While general data searching and analysis techniques do exist, they are not customized for this particular domain.

The process of the Intelligence Cycle is characterized by separate tasks, which are being carried out by different parts of the intelligence community. Traditional intelligence cycle separates collectors, processors, and analysts which often results in losing valuable information [14]. This approach can be inefficient in circumstances involving complex, dynamic events and highly non-linear situation developments. In real-time problems, this can trigger serious obstacles, thus impeding efficient collaboration and appropriate actions. In addition, one of the biggest challenges for the intelligence analysis is responding to the time constraint.

The architecture of the Intelligence Information System is based upon the Intelligence Cycle, consisted itself of four phases: information planning phase, information collecting phase, analyzing (information processing) phase and information disseminating phase. Hereinafter, we would like to discuss the automation of the second, the third and the fourth phase in the context of the Intelligence Cycle framework.

The purpose of the Smart Web Portal (Figure 2) as a component of the Intelligence Information System, is to manage information that are collected, processed and disseminated [7],[8]. Therefore, it should be capable of executing three main functions: gathering (collecting) information from different sources, analyzing (processing) collected information and disseminating analyzed information. Thus, the Smart Web Portal system will be comprised of the following modules:

1. Collection Module – generates relation between intelligence information and stores data from different sources;

2. Processing Module – updates and enriches knowledge database;

3. Dissemination Module – creates and stores users, and updates existed user profiles

The Knowledge database communicates information to the Collection Module, since the functionality of the Processing Module depends on data that are stored in this database [9], [10]. The enrichment of the Knowledge Database is based on the process of semiautomatic annotation which starts with the search engine, whose responsibility is to update data in the system. The Search engine will search through databases of web services that are components of the Intelligence Information System. Each of these web services is an interface for a different type of sensors which collect Intelligence information. Collected information can be converted in a machine readable format and sent for an annotation process, which is based upon concepts and relations applied in Collection Module ontology. When the process of annotation is finished, a message i.e., an e-mail is sent to the administrator as a notification of annotated information, upon which the administrator starts a verification function. The result of this process is a final set of annotated information.

Intelligence information that is collected and stored in the database of the Collection module is in a form of raw data of various types: text, audio, video, image etc., which can be enriched with metadata. A notification is sent to the user (here, the intelligence officer) that information is collected

from a certain service. Next, the user manually fills out a form that is related to metadata about this information. Metadata are important for the analysis in the Processing and the Dissemination Module, since they allow introducing analysis techniques such as text classification and clustering. Another feature of this module is information indexing (with common, widely used techniques being stop-word removal and stemming).

From this point on, information is processed and disseminated automatically to the end-user of the system. In the Processing Module, data are subjected to clustering and text classification functions. The first function performs information grouping based on their similarity, while the second function provides classification of information into predefined categories. Applying text classification and clustering for grouping documents into categories will contribute for a dynamic, similarities based data organization. Furthermore, visualization techniques can be applied to the vast data set in order to discover patterns, trends and meaningful links that may reflect past and current situation developments. Techniques for data mining could also be incorporated while by considering probability assignments, uncertain information could appropriately be taken into account when needed.

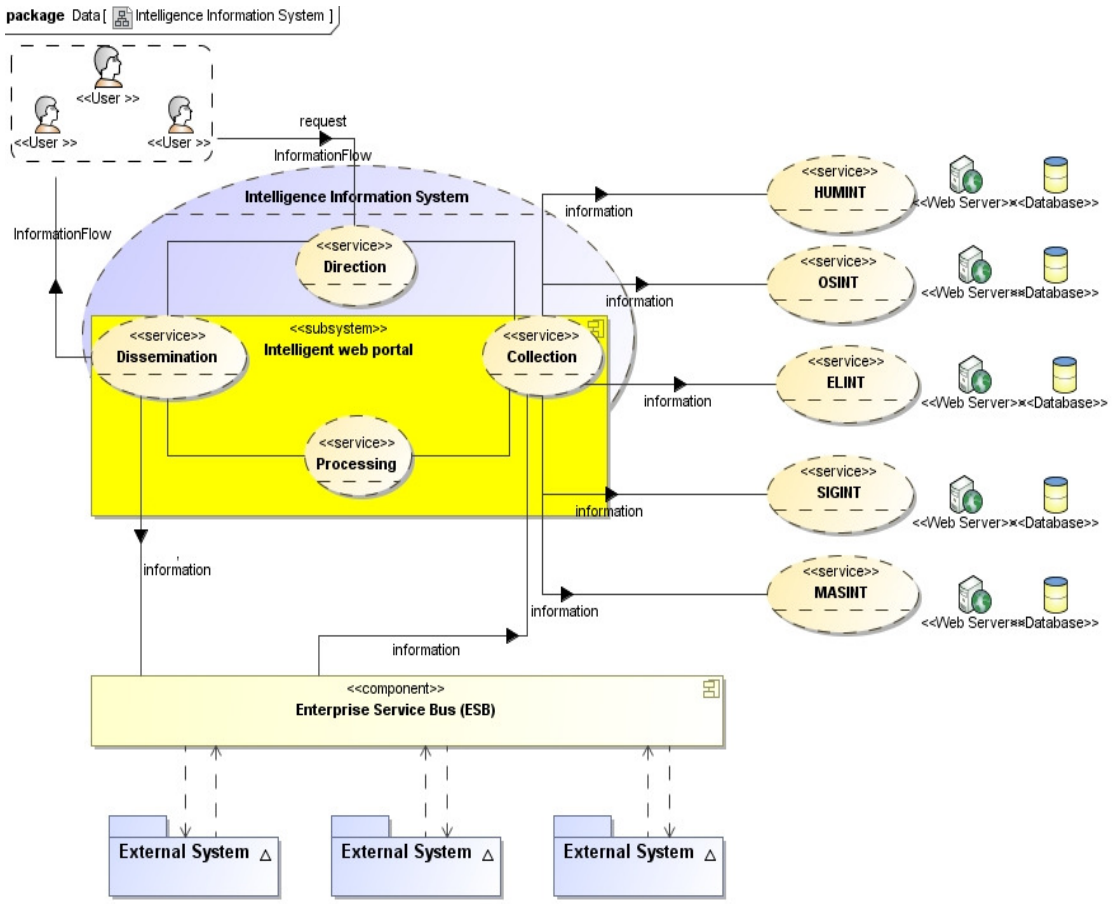

Figure 2: Framework of the Smart Web Portal

All of these functionalities can significantly improve the process of the intelligence analysis of retrieved information.

The organization and techniques that are applied during the phase of data processing are crucial for successful introduction of the Dissemination Module. Information is sent to the user responsible for managing the specific type of intelligence information. Additional features that can be used in information dissemination are users' logs and profiles, assuring that information are sent to the right user.

We should be aware of the fact that an intelligence-oriented Web Portal requires appropriate ontology, well developed to express complicated and possibly contradictory information. The classes should be organized in reference to people, objects/places, events and data related to them, being at the

same time sufficiently comprehensive but not overly specific [15]The properties and classes that reflect specified activities can be complicated and the linking between classes would not necessarily be evident. Furthermore, teams that work on specific issues could create subclasses in response to needs, with properties and rules according to monitored issues. When organized around mutual ontology, separate databases could be merged for the purpose of serving a more complex matter. It is also essential that the ontology remains on a manageable scale and not expand to a multitude of classes, so that the prospective user is able to understand and manipulate it.

V. Conclusion

Implementing intelligent information system into the Intelligence domain contributes for an appropriate and flexible use of information, promoting its search ability and exploitation attributes for the purpose of raising National Security. Intelligent systems can improve current protocol of working in Intelligence, which can further generate new intelligence protocols.

When producing new data from the already given, the time that is required to do this will directly affect if and how these information can be used further on, especially when a time-critical decision making takes place. If promptly available, processed data will not significantly lengthen the Intelligence Cycle time. However, failing to provide crucial information when needed may yield these data to be obsolete or useless. With this in mind, the central contribution of this paper refers to an upgrade of an Intelligence Information System with a Smart Web Portal feature, composed of three modules combined together to automate the Intelligence cycle. The overall purpose of this feature is to store and organize specific information in a rapid and efficient manner, and ensure their delivery to the right end-user.

We single out the information overload issue and the lack of adequate analysis tools, which remain key issues that should be resolved in future. Having in mind the specifics of the intelligence domain, some strong multi-source integration strategies are needed. A possible approach in overcoming this hurdle is by using Target-centric Analysis which has already been discussed in the context of Intelligence Analysis (see [15]), where small teams work in developing specific issue databases. The Semantic Web is a powerful tool for giving information an adequate meaning, by defining concepts in a way understandable for a computer which can further be related to other, already existing concepts. Its flexibility will facilitate the implementation of useful data analysis applications and enable inclusion of rules for inferring possible relationships from data.

Finally, being one of the key requirements, our intention is to search for appropriate solutions for data annotation.

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