Challenges of Interoperability Issues for Enterprise Software and Applications

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Abstract: Business Integration is key endeavor of Enterprises. There are no confutations among Enterprise’s decision makers that to align their business with the current market, adaptation of SOA (Service Oriented Architecture) with their business processes is essential and so for most of the SMEs are aligning their business processes in this architecture. In another sense, the architecture followed by the technologies (i.e. web services, multi-agent systems) provides a way to make business processes automated, open and interoperable. In this way, talk of business automation comes inside. So now, most of biggest business organizations have automated business process and they need to think about interoperability to cooperate with other business processes for achieving business goals. But how will Business Organizations resolve challenges in case of business integrations? A business process needs to comply with internal controls, compliance and governance. In this paper we will highlight the key challenges of interoperability in enterprise software and applications.

1. Introduction

Interoperability leverages the ability of software products to work with other software products without special effort from end users. The capability to interact and exchange information both internally and with external organizations is a key issue in the economic sector. Successful enterprises understand the risks and exploit the benefits of Information Technology (IT), Business Integration, Business Intelligence (BI) and find ways proving platform for business automation, alignment of IT strategy with the business strategy, cascading IT strategy and goals down into the enterprise, obtain value from IT investments, provide organizational structures that facilitate the implementation of strategy and goals, create constructive relationships and effective communication between the business and IT, and with external partners and measuring its performance.

At present situation, organizations can create interoperable systems without inventing new technologies; they can the technologies like web services [1], multi-agent systems [1] and so on. The issues which arrived here is more than interoperability. We assumed that our technologies are matured enough to provide interoperability for software services [2]. Also we assumed that software and applications have their own controls [3]. Now the point is how much control the systems have to comply with the regulations or policies given by the government. Again we assumed that the systems have sufficient controls to comply with regulations but the point is how the systems will align regulations or acts when they want to interact. At least if there is any kind of violation in the policies at execution time, how the systems will be aware of it in terms of software regulations, privacy, security and so on. So the question is what kind of approach we have to follow, what type of architecture we need to come up with these kinds of violations. In this paper we have presented the most challenging issues of interoperability for enterprise software or applications in term of controls. Our ongoing research highlights all of these challenges. The most challenging issues we encountered are Enterprise Content Management, Compliance, and Service Level Agreement (SLA) [4] and Technological
barriers. In section two we describe how enterprise content management influences current business systems, in section three, we have described how compliance issues occur in systems operability and how much it is important for the system to align with compliance rules, in section three, we have what are the challenging issues to deal with SLA in terms of interoperability and section five we have shown technological constraints of systems interoperability. In section six we have mentioned about the antitrust laws for enterprise Interoperability.

2. Enterprise Content Management

Enterprise Content Management is the technologies used to Capture, Manage, Store, Preserve, and Deliver content and documents related to organizational processes. Structured, semi-structured, unstructured documents belong to enterprise contents. In case of enterprise interoperability, the importance of enterprise contents is very high. Because the key reason of providing interoperability to resource sharing in a coherent way so that the end users never know how the contents are manipulated.

To get the idea of the scope of this problem, consider just one enterprise content format: excel document which is still most commonly used application for generating financial statements. Accounting staff generate and distribute spreadsheets, line-of-business and managers check, change and re-distribute them; and workers across the company attach them to emails and save them to different storage (local disks, shared drives, portable media, intranet folder etc). The result is proliferation of inconsistent, undocumented financial saved across the enterprise and impervious to end user controls or error-checking. As example, A is application of SME A and uses resources of application B of SME B then how we will assure that the documents accessed by A are the latest one. The key points are how we can efficiently manage enterprise contents in interoperable software framework, how we can assure privacy for enterprise contents and so on. These are open research issues which are kind of focus of our research.

3. Identity Management and Access Control

A SOA architecture allows users to access services and a composition of services belonging to different domains in one session. Proper user authentication is required to gain access to the resources and services of an enterprise. Each enterprise has own policies and mechanisms (technologies) used to identify users and control access to resources (e.g. username & password, Kerberos, X.509, SPKI, RT0,). A very interesting research topic is how to provide interoperability between different standards and policies. Some work has already been done here. For example, SAML [12] provides a unified way of encoding and exchanging authentication and authorization information. However, this allows interoperability only at message level. Solutions for sophisticated access control involving different policies are missing.

Single-sign on (SSO) standards like Liberty Alliance [13], WS-Trust [14] and WS-Federation [15] allow users to authenticate once and then move inside a federation with this identity. But what happens when a user needs to access a resource outside a federation? Moreover, in dynamic environments federation does not scale up because of unstable relations between different actors. Solutions are needed for automated user authentication, authorization and access control that scale to decentralized environments.
4. Compliance
Compliance Management is the upcoming issue in Information Technology as the importance of e-governance has been proved true. Some common questions that we cannot avoid when we think to governance in Information technology:

- Do I have controls in place?
- Can I claim that my controls are working?
- Do my operations have acceptable risk profile?

We need internal controls in Information Technology to be accountable as we want a system that raises the visibility of controls and provides clear report to all stakeholders that the controls are working. Organizations begin the process of complying with business regulations such as Sarbanes-Oxley [5] or Basel II [6] or HIPAA [7]. Compliance for IT organizations provides the documentation of proper execution of decisions. In a way, compliance management automates IT governance by providing sufficient control in the systems.

Systems should comply with the laws, regulations and contractual arrangements to which the business process is based on, i.e., externally imposed business criteria as well as internal policies. To prevent fraud cases inside business processes organizations should apply strong governance in their systems. So the business processes need controls. According to COBIT 4.1 [3], “Control is defined as the policies, procedures, practices and organizational structures designed to provide reasonable assurance that business objectives will be achieved and undesired events will be prevented or detected and corrected.” So there are standard IT controls objectives and each of the IT control objectives provide a set of high-level requirements to be obliged by management team or decision maker for effective controls of IT processes.

The interesting problem will occur when two or more systems are promised to comply with policies or act which are not the same and differ from system to system. This situation can occur due to territorial laws, geographical locations of the systems and political perspective. As for instance, say Organization A is a US based organization and complies with Sarbanes-Oxley Act whereas organization B also is an EU based organization and complies with Act given by European Commission. Now in case of interoperability if A needs access a service from B, but A will not be allowed to do so that, as controls imposed in these systems are different from each other. A complies with Sarbanes Oxley Act, whereas B (is not sure?) doesn’t sure about the acceptance level of it.

5. Service Level Agreement
How does a typical Service Level Agreement (SLA) manager work? It takes an SLA in machine understandable way, always monitors the services and alerts the provider if any violation of SLA occurs in the systems. So defining of SLA in machine understandable
way and selecting appropriate KPI, monitoring SLA, analyzing SLA are the emerging challenge in SLA management. We assume that the systems perform well to operate the functionalities of SLA. Our concern is how to maintain SLA constrain in terms of enterprise interoperability. Well, there are many SLA monitoring tools [8] for defining, describing, constraining and maintaining SLA. The tools collect information from service providers and service users and always check if there are any violations of SLA between them and alert the parties. Now interesting point is should we also depend 3rd parties to ensure SLA to make the systems interoperable. The objective is to make the systems coherent by reducing technological difficulties of the end users. So the concern is not only to provide interoperability but also need to define policies by which systems could be self interoperable without depending on third parties.

6. Technological Barrier

As we know, Web service [9] is a software application identified by a URI, whose interfaces and binding are capable of being defined, described, and discovered by XML artifacts, and supports direct interactions with other software applications using XML-based messages via Internet-based protocols. A network component in Web Services architecture can play one or more fundamental roles which are Service Provider, Service Requester and Service Broker. The three fundamental operations of Web Services are Publish Find and Bind. For instance Google Calendar is a web service which is getting popular for personal and commercial usages.

A Multi-Agent System [10] is a distributed system composed of autonomous entities, called agents. These agents need to interact and cooperate in order to achieve global tasks. The tasks are defined by the agent’s owner. One of the main properties of MAS is that it relies rather on the distribution of cooperation algorithms than on centralized processes. The decentralized and loosely coupled nature of the network makes it possible to design applications that are highly flexible, scalable and adaptive.

The operational structures of agent based systems and web services are almost the same. For example, agent service uses agent broker which provides information about activities of particular agent, similarly web services have service broker which contains information of a particular web service. So what happens if a web service wants to invoke a service offered by an agent based system? Is the system allowed to do that? Simple no, due to technological aspects these two services can not be merged so easily. As a web service uses SOAP messaging for communication where as agent services uses ACL for communication. In a way, we need a middleware which will work for both of these two technologies. But how a user knows which service is able to provide such type of gateway to invoke an agent or web services to fulfill it needs. Should we need one step higher level technology which aligns both agent services and web services?

In figure1, red texts indicate technological differences between agent service and web services.
7. Legal issues for interoperability

There are tremendous challenges to protect antitrust laws in case of proving Enterprise Interoperability. Interoperability of software and services in a way technical contacts between two systems so that there will be a committed mechanism of communication among each other. There are many legal issues arising when two organization start working jointly, especially when the systems reside in different territories or different countries. Let’s think about antitrust laws. How can you prove that your system is aligned with antitrust laws and there are no violations of the laws in the interoperable systems? As for instance, the Sherman Antitrust Act [11] prohibits both unreasonable restraints upon and monopolization of trade.

Section 1 of the Sherman Act is the most important and most frequently applied of all of the U.S. antitrust laws. In part of unreasonable restraints the law declares:

“*Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal.*”

It applies if the following conditions are met:
There must be a contract or combination behind any general interoperability issues there are some policies among the systems or software products. It is, therefore, necessary for at least two systems to agree or to act in concert for there to be a violation of Section 1. The contract or combination need not be formal or written; a “knowing wink” or, under certain circumstances, a consistent, parallel course of conduct between systems can form the basis for an illegal agreement.
The contract must be in restraint of interstate or foreign commerce. The term “interstate commerce” is construed liberally to include restraints within a single system or state, if those restraints have a significant impact upon commerce between systems or states. The contract or combination of systems must be an “unreasonable” restraint on competition. Experience has revealed that some restraints, such as price fixing, are always unreasonable; other restraints, such as assigning distributors specific marketing territories, are examined on their facts to determine their reasonableness. Promotional and
consumer awareness activities all these activities should be generally analyzed under the rule of reason, unless the activities constitute a pretext for an anti-competitive purpose.

8. Conclusion
In this paper, we provide emphasis on the challenges of software interoperability. We believe, there is no alternative of interoperability of software products in the current business world, but it is also important to have very efficient solution of the challenges we have mentioned here to get the benefits of software interoperability.

References
[3] Cobit 4.1 (Control Objectives for Information an Other Technoligies), http://www.isaca.org/AMTemplate.cfm?Section=Downloads&Template=/ContentManagement/ContentDisplay.cfm&ContentID=34172