Web Service Composition Using Standards: Solution for a Flexible Service Oriented Environment

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Abstract: - Service Oriented Environment focuses on the individual service as the main based on which the environment build its architecture, procedures and rules. In this paper we share a summary of research work that has being done over many years tackling the issue of creating a dynamically changing framework that allows providing new services to accommodate newer requests. This will make the framework continuously adapting to new needs that may not exist in the available services. We use web services standards WSDL, WS-Policy and SOAP to handle service description, orchestration rules and service messaging. The orchestration is implemented using graph based to resolve the limitations of WS orchestration using the BPEL standard. The framework is used to generate new E-Learning services not existing in the Learning Management System LMS like the media generator and the course portfolio. These two new composed services have shown to improve the students learning and performance.

Key-Words: - Web Service Composition, Service Orchestration, Service Oriented Environment, WS-Policy, WS Standards, Graph Based Orchestration. E-Learning, Student Learning, Student Assessment

1 Introduction

A service oriented architecture SOA is defined as to provide components of applications as independent components through an appropriate software design. This provides a very flexible use of functionalities and software features regardless of their providers. The increasing cost pressure is forcing us to efficiently reuse existing systems while also developing new functionalities [1]

Education is no stranger to software limitations. When we looked at Learning Management systems we found that they offer similar functionalities 'gradebook, forum, assignment maker...ect; yet they all lack features that may be specific to a given course, student or an educator. Such as for a music class the educator may want to use a music composition application that definitely doesn't exist in the LMS; while it does exist as an independent application. Merging the two is definitely an expensive and unpractical solution because a given LMS cannot include every application that may be needed. Therefore, the only way to use functionalities and features of different applications as if they were one is to compose them using service composition. In business environment service composition was widely used as a cheaper solution to merging companies however it is mainly static. Which means the services that will be composed are known ahead of time and based on that the composition is set up. The solution is known and guaranteed. However this design doesn't allow the system to adjust based on users and company's changing requests and doesn't automatically allow adding newer services. On the other hand we found that in academia since research is not result oriented we found that dynamic service composition was the most common and interesting approach to follow. When we investigated the different dynamic approaches used we found that the rule based compositions tend to give the most optimum results although it is the least used. The reason behind that is that rule based composition accommodates different scenarios, services, requests...ect. This is because a formula based rule can encapsulate many possibilities. However rule based composition is not widely used because it's harder to implement. And most funded research projects require concrete results because they usually work on real life solution (like the e-transfolio in the University of Catalonia). The aim of our research is to find the most appropriate service composition solution to achieve the optimum results for SOA solutions and therefore allow any LMS to accommodate different

learners' needs and therefore achieve optimum students learning.

2 WS Standards

SOA enables us to constantly compare the nominal and the actual and to react accordingly to fill the gaps or adapt the architecture to reflect changes in business strategy [1]. Unfortunately SOA is just theoretical. Therefore to achieve the true definition of SOA we found that dynamic service composition is the better choice. However for implementation there isn't a platform or framework that allows the creation of dynamic processes. Thus the efforts are towards creating common languages rules and specifications for web services WS. These are called web services standards. For the services to communicate in a dynamic way and be used interchangeably they all have to be described and manipulated the same way. Therefore, Web Services Standards is the flexible solution to avoid customization and reconfiguration of new services. Similarly standards offer interoperability and allow the system to keep on adjusting itself to accommodate future changes. We use WSDL to describe the WSs, SOAP as the messaging protocol for communication between the WSs, and WS-Policy to implement rules and restrictions such as security rules for service execution, authentication…etc.

2.1 WS-Policy

We chose to use WS-Policy to describe service specific rules, orchestration rules as well as other levels of the composition process. This was explained in [8]; where we have addressed the problem of execution of the orchestration for service composition. We have compared both decentralized execution verses centralized one. Then we have taken our project proposition as an example, in which we opted for distributed execution of service composition. Even though distributed execution has some disadvantages such as security and fault handling, we have listed how we can overcome these issues by the use of policies. Policies are a powerful solution for several reasons, including the fact that we have existing standards supporting the creation, integration and implementation of policies for web services. Moreover, policies require minimal alteration to existing systems in which the services reside. They also allow adding restrictions and constraints to the execution of a given service without the need to change the specification, design or recreate any existing service. All this helps us enforce the security measures needed in terms of exchange of data between multiple service providers as well as express and execute fault handlers. The choice of rule based or policy -based composition is because of its efficiency and result correctness.

Our original contribution is the use of semantic policies in monitoring and orchestrating service composition scenarios. Policies, defined as a set of IF conditions THEN actions are proposed to specify relationships and constraints over the occurrences of interactions between existing e-Learning basic services [8]. A Policy Decision Point (PDP) is then used to process policies specification and to trigger appropriate actions. The triggered actions will therefore automatically implement and execute new composed services; such solution is implemented in a very flexible manner because instead of using a policy description language we use WS-Policy which is the standard for describing rules for WS.

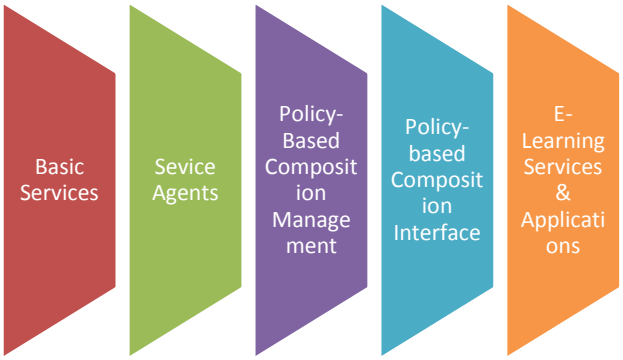

Fig1: Policy-Based Composition Management

2.1.1 Rule/Policy Based Orchestration

One would think that BPEL would be the appropriate choice for the service orchestration (executing the interaction between services); and it was our initial choice however we found several limitations in the implementation and there are few studies that showed the clear limitations of BPEL [10] such as centralized execution, As well as the lack of semantics among other limitations. For that we proposed an orchestration algorithm [7] that makes use of policies to manage interactions between services and generates a graph based on the participating services. Different traversals of the graph generate different processes meaning different new composed services based on existing ones.

We present a new service orchestration algorithm that is intended to orchestrate interactions between different web services. Generate a workflow of a set of web services in order to generate a composed service. We present an approach that aims to optimize the process of web service composition by

assigning the best service and service activities. This involves taking into consideration several parameters such as the execution time, cost of communication between services that may reside in different locations, constraints imposed by the user and the quality of service (e.g. response time, cost, reliability, availability, etc..).

3 E-Learning Services

The development of an E-learning application includes several areas: First technology or technical literacy: in order to put in use an e-learning system, we must first ensure that all the potential users have the knowledge and environment needed; this includes the basic knowledge, then the technical integration, next comes the training on the basic tools, later comes the development of a standard classroom and last is a digital library. Second aspect is the knowledge deepening: this begins by having a knowledge application which means a tool that contains the lessons, lectures...ect, then complex problem solving where users can complete exercises as well as quizzes or tests, Next we can include more complex tools, last will be to have tools that support collaborative work.. Once the requirements are well defined, the development process begins. There are several companies specialized in building e-learning tools such as BOSS, ASB and course maker.

The other approach is to build a customized e-learning environment. Such development requires several aspects: One is the pedagogy, which includes setting the goals and objectives, then the design approach, the organization, and the method and strategy. Second is the Technical aspect, which includes the infrastructure, hardware and software. Third is the interface design. Fourth is the Evaluation, fifth is the support and that includes online, onsite or by telephone. Sixth is the management, usually corporations and institutions with an E-learning environment would have a management team that makes decisions concerning all e-learning related issues. Finally, there is the Ethical and the Institutional element. The problem that arises is that even with all of the above key components taken in consideration the success of an e-learning environment is not guaranteed. It is affected by several factors including Institutional, technological (having an online tool in an area where the internet connection is slow), pedagogical, design and Socio-cultural one.

3.1 LMS Limitations:

In this section we are investigating existing e-learning tools in order to evaluate their functionalities. The goal at the end is to see if there is a tool that responds to all of the needs and if not then is there a tool for almost every need that can exist in E-learning. fig2 shows categories of E-Learning tools. In fig3 the listing of the tools is by type of pedagogy used.

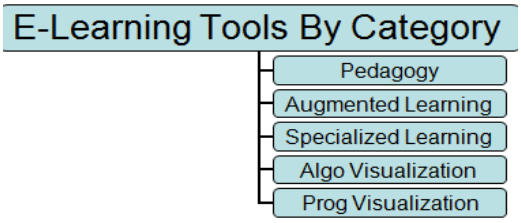

Fig2: categories of E-Learning Tools

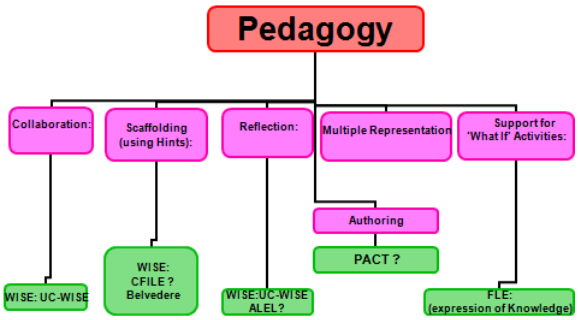

Fig3: Pedagogy based categorization of E-Learning Services

Boss, Course Maker and ASB are commercial products while the others are free. Such tools can also be categorized according to pedagogy used or provided by them.

Fig4 lists some of the tools that are based on augmented learning. This means we use such tools to teach a given skill by building blocks. They allow the student to learn on his/her own pace.

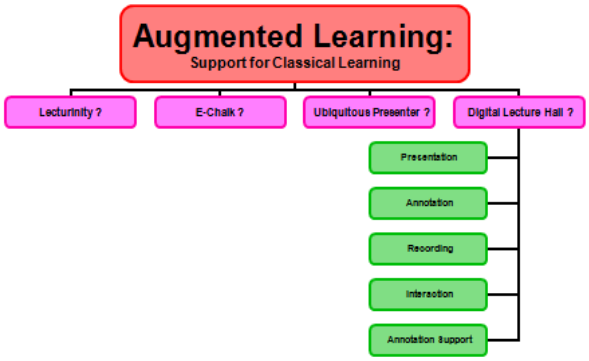

Fig 4: Sample of Services that provide Augmented Learning

The motivational example for our study is The E-Course Portfolio. It is intended to give an overall assessment of a given course based on the students' performance. It also includes all the content, assessment and activities used during the course.

Fig 5: basic services provide input for the composed service e-CoursePortfolio

The E-CoursePortfolio is further explained in [3]. In our work our goal is to provide the instructor/student and program managers with an E-ProgramPortfolio and from each course portfolio we can compose the program portfolio in order to assess the program effectiveness. The added value in our work is that we also include statistics on the number of students who have achieved a given competence which is the assessment program. Such information will be very useful for instructors.

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4 Conclusion

A fruitful and successful learning experience mandates that students are interested in the subject and that the knowledge is presented in an intuitive way. Due to the decrease in students' interest in reading, educators have to use other methods to ensure that learning is still taking place. We have presented the results of a study performed on an introduction to computers course for non-major students. The aim of every educational institution is to increase the students productive and success rate. Therefore, the study presented in this paper tackles one of several existing web solutions that may enhance the learning experience of students.

We have also presented an evaluation of a service orchestration algorithm for web service composition. Web Service composition has being addresses using different method and techniques one of those methods are rule based techniques. Although our method is rule based as well we are making use of WsPolicy as a web service rule standard. Also our algorithm allows the web service composition to be dynamic to a certain level by generating newer policies that will address the execution of the composed service. This resolves several issues including the fact that only minimal changes are needed to the existing environment. Newer web services may be added dynamically if they are described using the same WS standard used. This will allow the system to expand continually and dynamically. We have shown that we have opted to use policies as part of a decentralized execution of service composition in order to benefit from the advantages of distributed execution and solve its limitations

We have tested our proposed algorithm using a simple E-learning scenario which is to search for learning content (a video from YouTube), download it then upload it to the LMS. Our method preserves the restrictions and conditions for execution of each participating web service.

For future work a translator can be added to the current system in order to translate the user's request from natural language or any other service user language users choose to input their request in. The translator will then translate it into the service specification language used WSDL and therefore the system will be user-friendly.

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