Service Oriented Architecture of Assessment Model[1]

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I. Introduction

A Service Oriented Architecture (SOA) is a software model, in which the concept of a 'service' is an abstraction of a function used by an application.

Thousands of enterprises worldwide have adopted the principles of Service Oriented Architecture. SOA provides an architectural approach that brings the flexibility and agility required by today's global business environment [1, 5].

SOA addresses the business demand for applications to be responsive to business needs and to adapt to dynamic business environments. In SOA, services may be defined as Web services to provide a standards-based approach to interoperability.

The paper focuses on the build aspect of the service oriented architecture of the TENCompetence Assessment Model. To achieve this goal, it is necessary to describe requirements drive downstream design and development to transform assessment processes into composite applications that automate and integrate the business. The solution is designed to ensure that they are flexible and can be adapted as needs change.

The solution complies with the following general non-functional requirements:

• TENCompetence framework − the solution uses data and programming languages that allow integration of platform with existing infrastructure of TENCompetence framework (java, xml).

- Architecture of Assessment Model – the system must provide extensible architecture in order to achieve high adaptation for current needs as well as to give opportunity to extend it for future needs [2].
- Services Based Architecture – the solution must provide service architecture for higher flexibility and easy improvements.
- Interface to be user friendly and to have appropriate coloring scheme, with no contrasting colors (except for the error and warning messages).
- Repository – the solution must support a repository with Unit of Assessment xml templates, and to give tools for easy access to them.
- Standards-based – wherever possible and practical, the tools and service should conform to IMS QTI standards and specifica-tions.

II. Assessment Model

The TENCompetence Assessment Model aims to cover the life-cycle of the assessment process. That model makes it possible to implement various assessment techniques which allow development and design of assessments that are specific for the competence development [3].

The model is built on several sub-models, each matching a different stage in the assessment process (Fig. 1). According to the Assessment model, there are five main packages which describe all the functionalities of the assessment process.
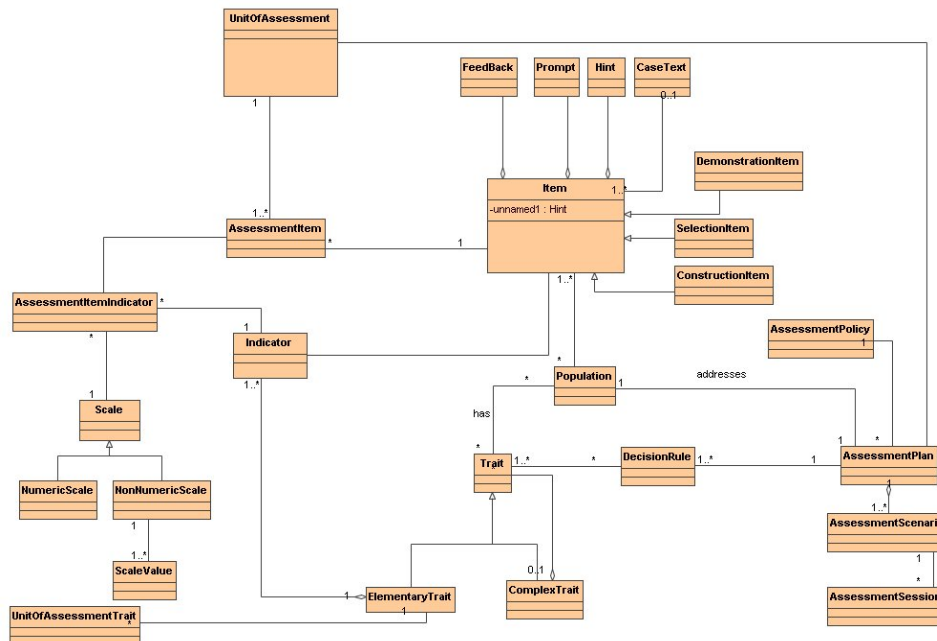

Fig. 1. TENCompetence Assessment Model

The Assessment Design stage defines the Assessment Plan which is a complex object containing different factors and guidelines from the pedagogical model of the assessment. The Assessment Plan focuses on specific traits of the individual

person(s) or group(s) which are assigned to it, by using the decision rule as well as specific assessment policy which has to be followed.

In the core of the second package (Item Construction) is the Item which can be of a different type: a construction, a selection and a demonstration. For the proper description of the functionality of the Item, the following components are used: Prompt, Case text, Hint and Feedback.

In the Assessment Construction package the output is the Unit of Assessment, which consists of one or more Items according to the Assessment Plan. It defines the type and value of the Scale which specifies how the candidate's response has to be translated into a score.

The Assessment Run package is the process where the candidate undertakes an assessment and his/her answers are recorded in the ItemResponse for every single Item. There are two main objects: AssessmentTake and ItemResponse.

In the Response Processing package the main object is the Assessor. It is responsible for two major steps: To transform the candidate's response, represent as Item Response in the model, into a rubric score using the defined transformation rules and to calculate the Assessment Indicator Score for each candidate.

III. Research methodology

Our research approach is based on the following methodology (Fig. 2):
- Overview of the problem(s) in the assessment area (Stage 1),
- Design model, described in 'Assessment model' section (Stage 2),
- Development of prototype software tools (Stage 3),
- Tool evaluation and analysis (Stage 4),
- Based on results – development of a service oriented architecture (Stage 5).

In the current paper more or less we concentrate our work on the last bullet – Stage 5, which comes as a result from Stages 1-4.
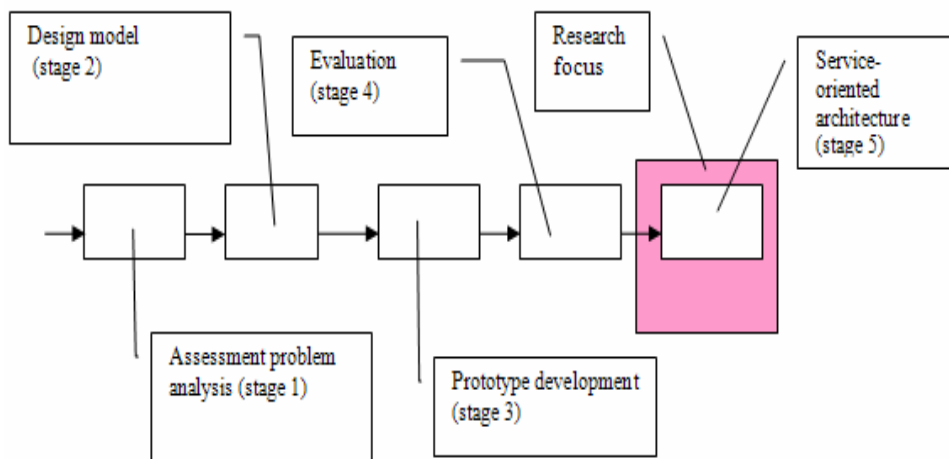

Fig. 2. Methodology steps in assessment SOA development

Thus the focus is on developing SOA for assessment.

IV. Service oriented architecture of the assessment model

When transforming the architecture to a SOA, an important step is the definition of the services.

Fig. 3 shows the SOA of the Assessment Model. The following overview provides a brief look at capabilities, how they fit into an SOA approach, and the technologies that support them.
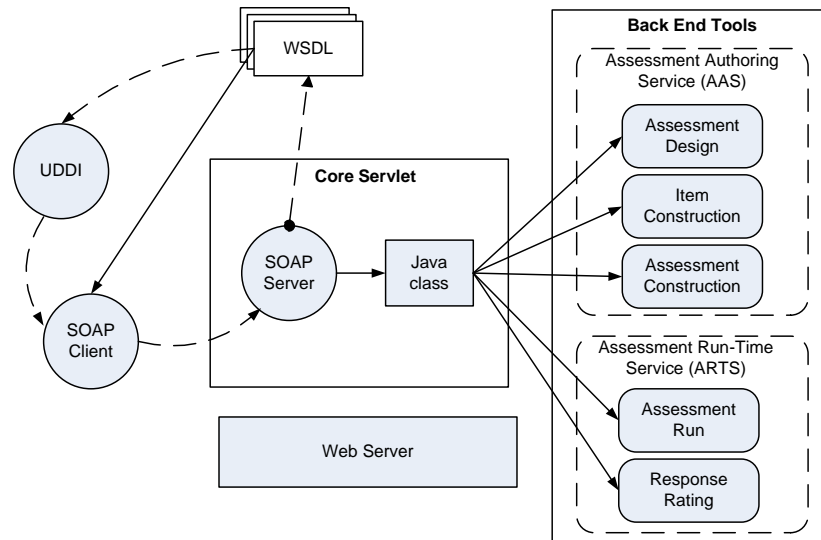

Fig. 3. SOA of Assessment Model

Assessment Design Service (ADS)

This service will be responsible for the creation and editing of an Assessment Plan. The main object is the Assessment Plan. It is defined in terms of units of assessment and their assessment types, as specified from the assessment scenario, determining their sequence and time dependencies. The Assessment policy prescribes which assessment types (methods) can be used and under what conditions. The Trait is an abstract object used to measure different personal characteristics. Identifying the most appropriate people to rate the performance of the individual is a key part of the process. Ideally, the recipient will have full involvement in identifying who they think is in the best position to comment on their performance. In the context of the Assessment Model, all participants in the process are called Population, and the assessed competence or performance level – Traits. It is also important to consider briefings with all participants on the objectives of the process and some basic tips for completing the questionnaire, called Assessment Policy, for example highlighting the importance of marking observed behavior.

Assessment Construction Service (ACS)

The central object in this stage is called Unit of Assessment. Each Unit of Assessment corresponds to a particular Type of assessment and includes one or more Items. It defines the type and value of the Scale which specify how the candidate's response to be translated into a score. There are two types of scales: numeric and non-numeric scale. Unit of Assessment will be loaded and stored into the local

file system; a special repository or specific database in XML format are easy to be accessed and reused.

Item Construction Service (ICS)

The Item Construction Service provides the different types of Items, defined in the Item Construction package: such as QTI Item, or some other forms, for example demonstration item. Every item has been assigned (one or more) Indicator(s) of the trait of the assessed concrete individual person(s) or group(s). In order to extend the functionality of the Item, Hint and Feedback are included.

Assessment Run-Time Service (ART)

The runtime service will be responsible for the assessment run and grading, resulting in providing rates and evaluation reports.

IV. Functional requirements of the system

We have defined the following functional requirements for each of the following five services.

Assessment Design Service (ADS)

The ADS must possess certain capabilities to support the assessment design process:

* To support activities related to the creation and support of a digital repository with assessment materials such as Assessment Scenarios and Assessment Plans.
* To supply a tool for creating, editing and deleting of an Assessment Plan.
* To supply a tool for creating, editing and deleting of an Assessment Scenario.
* To search the assessment plans and assessment scenarios.
* To define Traits: elementary and complex.
* To allow XML for data exchange.

Assessment Construction Service (ACS)

The ACS must possess certain capabilities to support the assessment construction process:

* To support activities related to the creation and support of a digital repository with assessment materials as Unit of Assessment.
* To search for a Unit of Assessment.
* To supply a tool for creating, editing and deleting of a Unit of Assessment.
* To supply a tool for creating, editing and deleting of a Scale.
* To add or remove Items.
* To allow XML for data exchange.

Item Construction Service (ICS)

The ICS must possess certain capabilities to support the item construction process:

* To support activities related to the creation and support of a digital repository with assessment materials as Items.
* To search Items.
* To supply a tool for creating, editing and deleting of for Items.
* To define Hint, Feedback, Prompt, Case Text.

- To select the set of possible responses according to the chosen Response-type.
- To allow XML for data exchange.

Assessment Run-Time Service (ARTS)

- To allow defining of the parameters for Unit of Assessment and their type as selflearning, selfcontrol, peer assessment, 360 degree feedback, etc.
- The subsystem must register the results from some of the Unit of Assessment.
- The activities related to filling the items must provide opportunity to set the type of the answers (for example yes/no, 1/0, many-from-many, matching, graphics, etc.)
- The system has to provide opportunity for development of a Unit of Assessment based on a database of items.
- A unit of Assessment can provide access at different stages and types of exam (self-assessment, partial assessment, and full assessment).

This includes opportunities for a learner to:

- List all their Units of Assessment.
- View information about a Unit of Assessment and schedule.
- Evaluate a planned Unit of Assessment.
- Possibility to view (during the evaluation) the runtime information about evaluation process, such as estimated time, planned time, page information, assessment information (Assessment Session).
- Auto evaluation and auto feedback for some types of items.

V. Conclusions

The paper describes services defined in the design of SOA for an assessment model, according to the defined nonfunctional and functional requirements. All functions of the Assessment Model are modeled as services, which include purely business functions as well as system service functions. The other main issue is that all services are independent. They operate as "black boxes" and function by merely returning the results.

R e f e r e n c e s

1 F r e u n d, T. et al. ESB Interoperability Standards. IBM Corporation, 2008.

2. L a z a r o v a, M. Application of Geographic Information Systems in the Hydrological Modelling. – In: Proc. of International Scientific Conference "Computer Science'2004", Technical University of Sofia, Bulgaria, 2004.

3. K o p e r, R., M. S p e c h t. TenCompetence: Life-Long Competence Development and Learning, Competencies in Organizational e-Learning: Concepts and Tools. Idea Group, 2007.

4. S c h o o n e n b o o m, J., C. T a t t e r s a l l, Y. M i a o, K. S t e f a n o v, A. A l e k s i e v a – P e t r o v a. A Four-Stage Model for Lifelong Competence Development. – In: Proc. of the 2nd TENCompetence Open Workshop, Manchester, 11-12 January 2007, 131-136.

5. S e b o r, J. Seven Steps to SOA Success. (Cover Story). – CRM Magazine (serial online), **12**, May 2008, No 5, 32-37. Available from: Academic Search Premier, Ipswich, MA.

Сервисно-ориентированная архитектура модели оценки

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(Р е з ю м е)

В работе представлена сервисно-ориентированная архитектура (Service Oriented Architecture, SOA) инструментов, которые помагают оценивании процесса обучения и результатов, подходящих для улучшения компетентности. Поставлена следующая цель: разработать новую интегральную сервисно-ориентированную архитектуру, включающую современные методы оценки вместе с классическими тестами. В первой части статьи описан процесс оценки, который представлен в следующих этапах: проект оценки, конструирование элементов, конструирование оценки, выполнение оценки и классификация. Представлена более обобщенная архитектура процесса оценки в соответствии со спецификацией SOA. Представленны функциональные и нефункциональные требования как основа развития этой архитектуры.