A SOA-BASED SYSTEM INTERFACE CONTROL FOR E-GOVERNMENT

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Abstract: In this paper, a SOA-based system approach is presented for system interface control in sustained systems. Once a system is completed developed, it goes into a sustained phase supported by many interfaces. As new technologies develop, updating and maintaining such systems require non-trivial efforts. A clear pre-requisite before the deployment of a new system is to clarify the influence of changes on other systems connected through interfaces. However, as each sustained system manages its own information separately, integrating relevant information among the interfaced systems is a major hurdle to build SOA in E-Gov. Therefore, the XML technology is applied to support system interface control toward SOA using step-by-step approach in E-Government. In particular, I focus on messaging interface issues in Health Level Seven typically used in medical information system and propose SOA framework cube and a scheme to represent message information that can be used for the decision support of interface impact between sustained systems.

1 INTRODUCTION

For E-government, Service Oriented Architecture (SOA) is a new paradigm and driving force for developing and integrating multiple systems. SOA is an approach for building distributed systems that deliver application functionality as services to end-user applications or are used for building other services.(Duermeyer, 2005) As the components of E-Government are diverse containing multiple vendors systems deployed, system engineering efforts toward SOA are necessary for not only internal factor but also externally used. It is expected that many E-Government system being migrated into web-enabled services. Since system environments change rapidly and engineering change efforts for interface control are increasingly significant, many documentation associated with E-government is considered to carefully examine in terms of non-functional view as well as functional perspective.

Overall, for SOA, an architectural style between components is loosely coupled. Since the key of E-Government are document-oriented designed, the exchange between each components based on E-Government document should be standardized.

Interface Control Document (ICD), which is one of the key documentation for configuration management for interface change, contains the description about exchanging requirement and concept of operation between interfacing system and

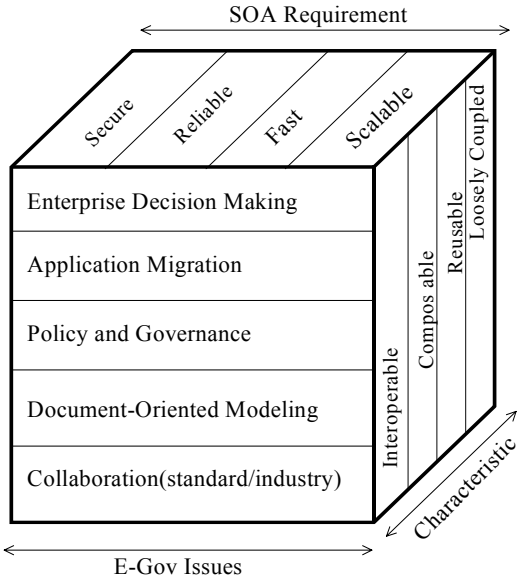

Figure 1: SOA-based System Interface Control Framework Cube.

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how they should be implemented and maintained (MIL, 2004). The proposed approach, therefore, is the SOA-based framework of for system interface control using XML, which is one of standard for exchanging information like Figure 1.

This paper suggests an effective process and method to consider interface control requirement while migrating multiple applications toward SOA-based environment. For dealing with the interface control, SOA-based metrics approach for interface control analysis is discussed and prototyping environment for testing is also suggested as a lightweight tool. In order to figure interface control requirement out, Engineering Change Proposal (ECP), which is common vehicle of configuration in E-Gov is addressed as an exchanging the change (Yoo, 2004)

Furthermore, since there is system resource information without specification, common vehicle to exchange information effectively is required. In this paper, *Extensible Markup Language (XML)* technology is used for supporting engineering change efforts for impact analysis. An XML is widely used as a standard for information exchange on the World Wide Web.(W3C, 2000)

2 BACKGROUND

In the past, it is shown that E-government capabilities for communication are email, conference call and discussion board (such as bulletin board system). But these tendencies are being moved to web services and effectively collaborative way to interacting with customers.

Under considering an world-wide deployed US health system involving 8 sub-systems A through H with more than 50 to 200 sites, a impact analysis for interface control is essential for decision-making.(Yoo, 2005).

In case that current E-Gov systems are connected each other, the change of specific system for migrating the SOA affects other systems connected (Duermeyer, 2005). Therefore, enterprise-level planning for the application migration is necessary to reduce conflicts and negative side effect and to increase efficiency and effectiveness. It is essential for enterprise-level planning to analyze current status based on system documentation as an input. E-Gov systems has contains Government off the shelf (GOTS) with sustained phase. These systems had developed diverse level of documentation baseline while maintaining system. Because of limited budget, to invest the workload for standardized documentation baseline is difficult.

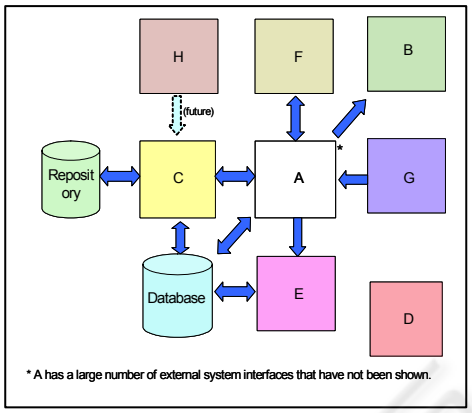


Figure 2: Sustained System Interface Architecture.

Furthermore, as each system change toward the SOA purpose has different requirement and timeline, the process with considering system interoperability under SOA should be considered (Duermeyer, 2005).

Moreover, consider the interface between systems A and B. The *Health Level Seven* (HL7) protocol messaging supported by the interface engine between A and B is given in Figure 2 as an example.

In table 1, the several cases of system for checking status with priority toward the SOA are presented. In priority (1-5), there is various factors to represent system status to migrate SOA. But the analysis result is dependent to Subject Matter Export (SME)'s knowledge and experience. And there are many cases existed not for sure.

Table 1: Change Case Table for the system.

Systems / Issues	A	B	C	D	E	F	G	H
Enterprise Decision Making	e4	e3	e5	e1	e3	e4	e2	e3
Application Migration	a1	a5	a2	a4	a3	a4	a1	a5
Policy and Governance	p2	p3	p5	p3	p4	p3	p3	p4
Document-Oriented Modeling	d5	d3	d4	d3	d2	d2	d3	d4
Collaborate (standard/ industry)	c4	c5	c4	c5	c3	c4	c2	c3

(1:lower priority~ 5:higher priority)

If more issues regarding E-Gov are considered, the situation for system analysis for interface control toward SOA is getting harder than previous case.

3 SOA-BASED ARCHITECTURE FOR INTERFACE CONTROL

In this paper, the way to conduct system interface control toward SOA is discussed for System Engineer more effectively and accurately in time manner. As there are increasing requirements for information exchange and service sharing in a unified manner, the situation of change request based on health system using HL7 protocol is considered. And the effective representation is addressed using XML.

```
<?xml version="1.0" encoding="EUC-KR"?>
<HL7import>
  <Segment1>MSH
    <Element1>
        <Field1>^</Field1>
        <Field2>~</Field2>
        <Field3>\</Field3>
        <Field4>amp</Field4>
    </Element1>
    <Element2>ADT1</Element2>
    <Element3>MCM</Element3>
    <Element4>LABADT</Element4>
    <Element5>198808181126</Element5>
    <Element6>Security</Element6>
    <Element7>
        <Field1>ADT</Field1>
        <Field2/>
        <Field3>A01</Field3>
    </Element7>
    <Element8>MSG00001</Element8>
    <Element9>P</Element9>
    <Element10>2.3.1</Element10>
  </Segment1>
  <Segment2>EVN
    <Element1>A01</Element1>
    <Element2>198808181123</Element2>
  </Segment2>
 <Segment3>PID
    <Element1>1</Element1>
    <Element2>
        <Field1>PATID12345</Field1>
        <Field2>M11</Field2>
        <Field3>ADT</Field3>
    </Element2>
    <Element3>MR</Element3>
 <Element4>
        <Field1>MCM</Field1>
        <Field2/>
        <Field3>123456789</Field3>
        <Field4/>
        <Field5/>
        <Field6>USSSA</Field6>
        <Field7>SS</Field7>
    </Element4>
    <Element5>
        <Field1>JOHNES</Field1>
        <Field2>WILLIAM</Field2>
        <Field3>A</Field3>
        <Field4>III</Field4>
    </Element5>
    <Element6>M-</Element6>
    <Element7>C</Element7>
    <Element8>
        <Field1>1200</Field1>
        <Field2>N</Field2>
        <Field3>ELM</Field3>
        <Field4>STREET</Field4>
        <Field5/>
        <Field6>GREENSBORO</Field6>
        <Field7>NC</Field7>
        <Field8>27401-1020</Field8>
 </Element8>
    <Element9>GL</Element9>
    <Element10>(919)379-1212</Element10>
    <Element11>(919)271-3434</Element11>
    <Element12>S</Element12>
    <Element13/>
        <Field1>PATID12345001</Field1>
        <Field2>2</Field2>
        <Field3>M10</Field3>
        <Field4>ADT1</Field4>
        <Field5>AN</Field5>
        <Field6>A</Field6>
 <Element14>123456789</Element14>
    <Element15/>
        <Field1>987654</Field1>
        <Field2>NC</Field2>
  </Segment3>
  <Segment4>NK1
    <Element1>1</Element1>
    <Element2>
        <Field1>JOHNES</Field1>
        <Field2>BARBARA</Field2>
        <Field3>K</Field3>
    </Element2>
    <Element3>
        <Field1>WI</Field1>
        <Field2>WIFE</Field2>
    </Element3>
    <Element4>
        <Field1>NK</Field1>
        <Field2>NEXT OF KIN</Field2>
    </Element4>
  </Segment4>
  <Segment5>PV1
    <Element1>1</Element1>
    <Element2>1</Element2>
    <Element3>
        <Field1>2000</Field1>
        <Field2>2012</Field2>
        <Field3>01</Field3>
    </Element3>
    <Element4>
        <Field1>004777</Field1>
        <Field2>LEBAUER</Field2>
        <Field3>SIDNEY</Field3>
        <Field4>J.</Field4>
    </Element4>
    <Element5>SUR</Element5>
  </Segment5>
</HL7import>
```

Figure 3: Converted XML from HL7 Sample Message.

Figure 3 is the corresponding representation of HL7 example. XML representation is more understandable for System Engineer and scalable to different format for future needs. Whenever appropriate, it can be possibly triggered and converted by the development. A common environment as shown in Figure 4 can be built for further testing and the simulation of the impact analysis on the interface. As an input, interface related documentation information such as ICD, and more for specific systems, Online log file and parsed data at the developmental engineering lab for testing are considered. Most components are smoothly linked through XML and triggered by XPath.

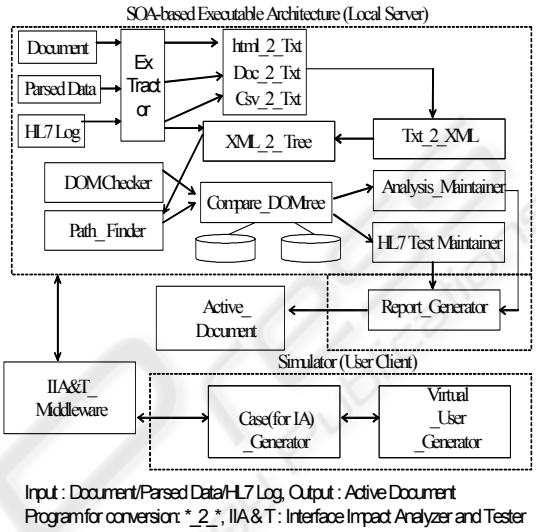


Figure 4: Proposed XML-based Architecture.

The simulation system is designed to equip the scalability for the future demands. In other words, the experiment with another non-functional requirement system on security as well as performance tool and an extension of the rule domain upon the future demands are combined.

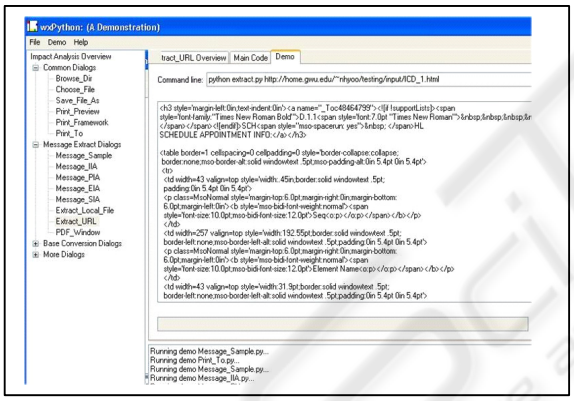
In Figure 4, in order to compare DOM tree-based information, to maintain the HL7 message segment table and the previous test case history data set is needed as a database. At this point, the performing interface issue using the local server at the operational environment for simulation is out of scope in this paper, as the primary purpose of the simulation is on showing an efficiency improvement of the suggested impact analysis for the decision-making during developmental testing phase on whether or not a system change can be applied to the systems without causing any negative interface impact.

It is ensured that there are many more problems to which this technique can be applied. Using XML-based information, system and testing engineers save their time and support customers with more value-added service by getting more realistic information using testing requirement for impact analysis. More information with non-functional requirement for impact analysis in general is discussed later. Based on the testing for the research with XML-based

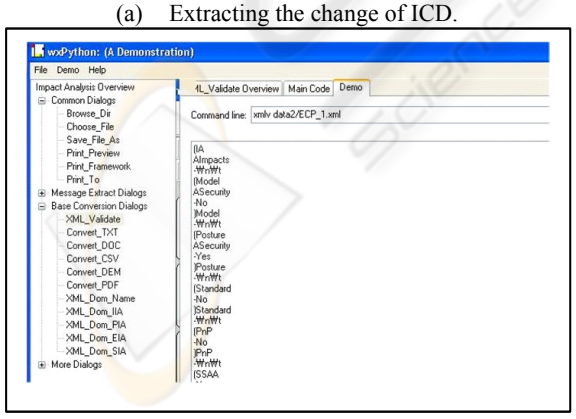
representation, an HL7 message transferred from system A to system B used is found only about 30% of the time in terms of message-level and only 50% of the messages are being used if I consider element-level. In other words, by using XML-based message modeling the meaningful portion of messages is identified for decision-making and is managed the part required to enhance interface impact analysis as well as updating impact analysis for each system.

4 STEP BY STEP MIGRATION APPROACH IN E-GOV

XML is primarily used as a communication medium between heterogeneous enterprise architectures. Using XML notation, the time for efforts and potential error is mitigated. This paper suggests step by step migration approach by representing combined scheme with HL7 testing and XML technology. Figure 5 is an example of extracting ICD documentation and ECP tracking for system interface control toward SOA environment.



(a) Extracting the change of ICD.



(b) Extracting the change of ECP using DOM.

Figure 5: Executable SOA-based IC Implementation.

As shown in Figure 5, we develop step by step approach for E-Government using converting diverse specification through XML technology and merge together even though engineering areas in government are different. A two-way mapping between generic XML workflow data and application specific document structure is provided. The mappings are based on XML techniques that allow translation and manipulation of an XML document into different representations in an efficient way. For traversing the information under the XML DOM tree structure, given algorithm using XPath and XSLT is used. XPath takes a navigational approach for specifying the nodes to be selected, hence a large number of navigational axes have been defined in XPath.

5 CONCLUSIONS AND FUTURE WORK

The engineering issues in E-government toward SOA are discussed to meet changing system interface requirement in systems maintenance phase. In particular, the SOA-based interface control is focused on in the presence of interface requirement and policy requirement for SOA in large scaled sustained system. A baseline using XML-based representation to handle changing system interface requirements is considered with the process for SOA. The XML-based step-by-step migration approach enables supporting System Engineers' collaboration effectively to meet the limited time requirement. Through a health system example, SOA-based IC framework cube are addressed as a case.

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