

# **IMPACT OF SERVICE REUSABILITY IN EDUCATIONAL INFORMATION SYSTEM**

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**ABSTRACT:** The Service-Oriented Architecture (SOA) is an evolving technology which can be fitted between the distributed computing and today's grid and cloud reusability in the educational sector. This paper makes an attempt to provide an experimental base for proving the reusability factor in the above experimenting with various reusability parameters in the Educational Information System (EIS) model.

**KEYWORDS:** Educational Information System, Reusability.

## **INTRODUCTION**

The Service-Oriented Architecture (SOA) is an effective way for publishing common features such as services and reusing the published services in building a complete application. The main purpose of service orientation is to ensure more service reusability through which service sharing can be enhanced. [1][2] The processes are prepared as a composition provided by different service providers. There are various parameters which are developed to test the reusability of the service components. The need for analyzing the reusability of the whole service has gained importance in recent years in various sectors. Various parameters are considered for the analysis of reusability constraints.

## **METHODOLOGY**

This paper has adopted an experimental approach to summarize the data collected relating to educational institutions. The measuring parameters are defined and applied on the data, providing various results to prove the reusability of services. This paper is a part of the research work which has created an Educational Information System (EIS) and has been further enhanced by applying various security parameters to the proposed model. This particular part of the research is an effort to prove the reusability of services within EIS model.

## **EDUCATIONAL INFORMATION SYSTEM**

The educational system considered in this paper is based on service oriented approach. Using web services technology, the consumers and the providers can circulate the educational contents in the form of different services such as learning object repository, digital library, placements, virtual classrooms, virtual labs, authoring services etc. The user can add as many as services by adding their own web service layer.

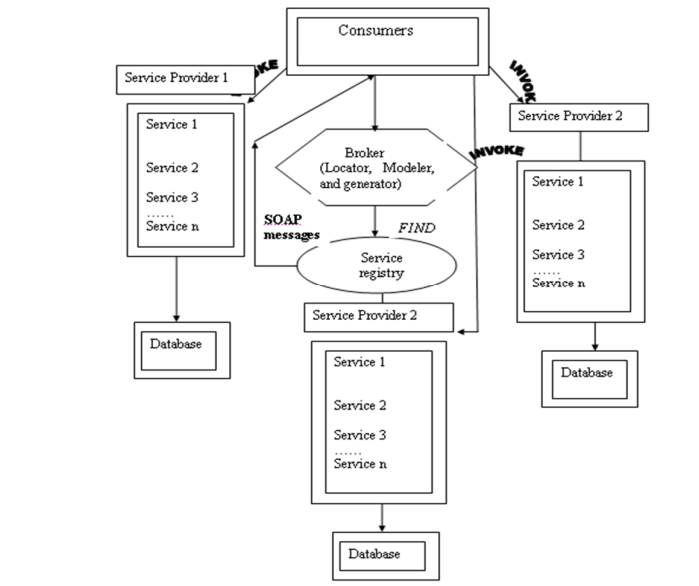


Fig 1. EIS model

## REUSABILITY

Reusability is the most demanding core principle of Service Oriented Architecture (SOA). Service reusability is the measure of ease with which one can use previously developed services in the new applications. The service can be reused in different tasks. It may be reused in the same system at the different level or it may be reused in many other systems. Designing service to be reusable will increase the Return On Investment (ROI) and also it reduces the cost associated with design, development, software testing and maintenance. [3][4]

### Attributes for reusability

1. The design should be more as generic as possible and it should cover current and future requirements of the consumer. Different application uses should be considered in a service design [5].
2. The Service should be designed for unknown requirements.
3. The service interface contract should be more generalized and standard compliant, so that it can communicate with many consumers.
4. Service should be easily understandable. More understandable service can be captured by many consumers.
5. Functionally the service should be rich.
6. It should possess good exception handling.
7. Service should easily be portable.
8. The reusable service should be independent of other services and business process.

Benefits of service reusability:

1. The reusable services reduce the application development time and cost for Reuse reduces the development time and cost.
2. Service reusability prevents the similar types of service creation. It avoids service duplication.
3. The service maintenance in an application environment becomes easier with the service reusability.
4. Service reusability increase the productivity by which the overall Return on Investment can be increased.
5. As the services are repeatedly used by many processes, the reliability of the services are proved and thereby the risk factors are reduced.
6. By reusing, a new business process can be assembled from the existing services to meet the current consumer's requirements and market needs.

## **REUSABILITY METRICS**

There are various reusability metrics are available. Khoshkbarforoushha et al [6] specifies the metrics for composite service reusability based on logic and description mismatch. Bingu Shim et al [7] propose a design quality model and metrics for assessing the quality attributes of service oriented architecture.

The parameters described by Choi and Kim (2008), provides a holistic analysis pattern.[8] It verifies the commonality and the adaptability to test the specified services on different application environment. The modularity verifies the object oriented characteristics of the services. [9][10] The standard conformance helps to analyze the standardization aspect of the services. The service reusability may help in the resource optimization with the educational system. This paper applies the reusability parameters with the model of Educational Information System and tabulates the advantages of the same.

### **1. Business Commonality**

Each and every service contains specific functions which are provided to the consumers. The commonality constraints can be measured provided by the services common to the consumers. The business commonality factor explains the way in which various similar business processes can use the same set of services. This helps the consumer to quickly identify a common service for similar requirements and enables the system to ensure the security parameters.

### **2. Modularity**

This is used to measure the loose coupling of a service. The main characteristic of SOA is its loose coupling (independent). If the services are dependent, then the consumer has to subscribe to all the dependent services. Modularity is the key factor which affects the reusability of a service.

### **3. Adaptability**

Reusability not only refers to a service that is consumed by a consumer repeatedly, but it also refers to a service consumed by different consumers with different specifications. Dynamic adaptations are possible with the specifications as a service.

### **4. Standard Conformance**

Standard compliance of a service can be assured by the SLA agreement contains the performance assurance given by the providers for each and every service defined. The services should conform to composition by service consumers without complications. The standard conformance provides foolproof technical feasibility of the services defined and invoked.

### **5. Discoverability**

The service requirements are specified and described by the service providers. The discoverability measure specifies the efficiency of a service in meeting the consumer requirements. Once an appropriate service is discovered for a particular requirement, then similar requirements can be easily handled and solved.

## DATA ANALYSIS

The Educational Information System contains different set of services provided by different service providers. Ten common services are chosen and considered for this analysis:

1. Fee collection
2. Form filling
3. Form verification
4. Merit list preparation
5. Enrollment
6. Eligibility verification
7. Seating arrangement
8. Mark list preparation
9. Reverification
10. Attendance

Table 1. List of operations

Service name	Operations( In sequential order of execution)
1. Fee collection	<ol style="list-style-type: none"> <li>1. Eligibility checking</li> <li>2. Deposit</li> <li>3. Refundable fees</li> <li>4. Other funds</li> </ol>
2. Form verification	<ol style="list-style-type: none"> <li>1. Total verification</li> <li>2. Eligibility verification</li> <li>3. Caste certificate verification</li> <li>4. Fees details</li> </ol>
3. Merit list preparation	<ol style="list-style-type: none"> <li>1. Mark wise list</li> <li>2. Stream wise list</li> <li>3. Category wise list</li> </ol>
4. Enrollment	<ol style="list-style-type: none"> <li>1. Roll number allotment</li> <li>2. Examination seat number allotment</li> <li>3. University norms verification</li> </ol>
5. Eligibility	<ol style="list-style-type: none"> <li>1. Marks verification</li> <li>2. Category verification</li> </ol>

	<ul style="list-style-type: none"> <li>3. Merit list details verification</li> <li>4. Preference verification</li> </ul>
6. Seating arrangement	<ul style="list-style-type: none"> <li>1. Course wise allotment</li> <li>2. Blocks Preparation</li> <li>3. Numbering</li> <li>4. Subject wise allotment</li> </ul>
7. Mark list preparation	<ul style="list-style-type: none"> <li>1. Enrollment verification</li> <li>2. Payment verification</li> <li>3. Total calculation</li> <li>4. Percentage calculation</li> <li>5. Grading</li> </ul>
8. Reverification	<ul style="list-style-type: none"> <li>1. Sealing</li> <li>2. Retotaling</li> <li>3. Revaluation</li> <li>4. Result declaration</li> </ul>
9. Attendance	<ul style="list-style-type: none"> <li>1. Monthly report</li> <li>2. Subject wise defaulters</li> <li>3. Overall percentage calculation</li> <li>4. Report generation</li> </ul>
10. Form filling	<ul style="list-style-type: none"> <li>1. Personnel details</li> <li>2. Professional details</li> <li>3. Caste Certificates</li> <li>4. Original data accumulation</li> <li>5. Permanent/Temporary contact details</li> </ul>

The first process is form filling, which contains four operations:

1. Personal details
2. Professional details
3. Eligibility details
4. Additional information.

The customers considered for this evaluation are as follows:

1. Students (2,000)
2. Faculties (50)
3. Placement agencies (50)
4. Office assistants (5)
5. Administration staff (10)

The values for the following calculations are collected from the administration team of the sample considered with the EIS model.

1. Function commonality FC (OP(i)) = Number of consumers requiring OP(i)/ Number of total consumers

$$FC(OP(1)) = 0.04$$

This calculates the function commonality parameter of operation 1. (Fee collection)

2. Modularity (MD) = 1-[Num services operating with dependency/Num total service operations]

$$MD = 0.4$$

3. Adaptability (AD) = Num consumer satisfied by variants/Num total applicable consumers

$$AD = 0.9$$

4. Standard conformance (SC) = [W mandatory standard \* Num conform to mandatory standard/Total mandatory standards] + [W Optional standard \* Num Confirm to optional standard/Num total optional standard].

$$SC = 0.6$$

5. Discoverability:

$$DC = \text{Num elements matching} / \text{Num total elements}$$

$$DC = 0.8$$

$$\text{Reusability metric} = \text{BCM} * (\text{MD} * \text{WMD} + \text{AD} * \text{WAD} + \text{SC} * \text{WSC} + \text{DC} * \text{WDC})$$

BCM describes the Business Commonality factor. Critical application may require the standard conformance with highest priority. In contrast to that, the educational applications may give more priority to the function commonality. W indicates the priority factor (in percentage) of different parameters in the whole application environment.

Reusability of service1 (Operation 1) = form filling = 0.02.

5. Complete calculations:

1	Personnel details	2115	50	0.9	0.05	2.40E-05	2	5	0.6	110	2000	0.06	0.67	0.56
2	Professional details	2115	110	0.9	0.05	2.40E-05	1	5	0.8	110	2000	0.06	1.33	1.09
3	Caste certificates	2115	50	0.5	0.53	1.20E-04	2	5	0.6	50	1000	0.05	0.56	0.47
4	Original certificates	2115	50	0.9	0.05	2.40E-05	4	5	0.2	50	2000	0.03	0.67	0.55
5	Fee eligibility verification	2115	50	0.9	0	0.00E+00	2	5	0.4	50	2050	0.9	0.4	0.77
6	Deposit	2115	50	0.9	0.05	2.30E-05	1	4	0.8	30	2005	0.01	0.75	0.61
7	Refundable fees	2115	50	0.9	0.05	2.40E-05	1	4	0.8	5	2005	0	0.83	0.67
8	Other funds	2115	50	0.9	0.05	2.40E-05	0	4	1	115	2000	0.06	1.4	1.15
9														0.8
10	Total verification	2115	5	1	0.03	1.40E-05	2	4	0.5	5	2050	0	0.67	0.53
11	Eligibility verification	2115	50	0.9	0.05	2.10E-05	2	4	0.5	50	2005	0.02	0.88	0.71
12	Caste certificate verification	2115	55	0	0.97	1.20E-05	1	4	0.8	10	55	0.18	1.2	1.05
13	Fees details	2115	55	0	0.97	1.20E-05	1	4	0.8	15	55	0.27	0.78	0.76
14														0.76
15	Mark wise list	2115	65	0	0.96	1.40E-05	2	3	0.3	50	65	0.77	0.71	0.96
16	Stream wise list	2115	65	0	0.96	1.40E-05	2	3	0.3	0	65	0	0.75	0.6
17	Category wise list	2115	75	0	0.96	1.60E-05	2	3	0.3	0	75	0	1	0.8
18														0.79
19	Roll number allotment	2115	55	0	0.97	1.20E-05	1	3	0.7	55	55	1	0.63	1
20	Examination seat number allotment	2115	55	0	0.97	1.20E-05	2	3	0.3	50	55	0.91	1	1.25
21	University norms verification	2115	55	0	0.97	1.20E-05	2	3	0.3	10	55	0.18	0.8	0.73
22														1
23	Marks verification	2115	15	0	0.99	3.30E-06	1	4	0.8	15	15	1	0.78	1.12
24	Category verification	2115	65	0	0.96	1.40E-05	2	4	0.5	10	65	0.15	0.8	0.72
25	Merit list details verification	2115	15	0.9	0.05	2.30E-05	3	4	0.3	110	2005	0.05	1	0.83

Fig 2. Complete Reusability listing

## RESULTS

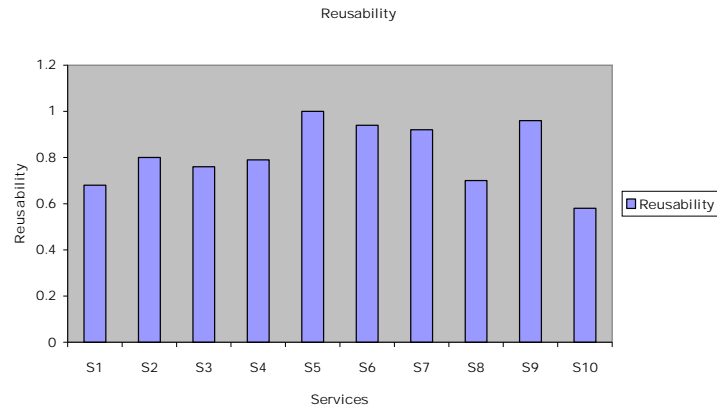


Figure 3. Service reusability analysis graph

Figure 3 indicates the reusability factor of all the 10 services considered for the analysis. The values are indicated in the scale of 0 to 1. All the services are having the reusability factor above 0.5 and the maximum of 1. None of the services are having the reusability factor as 0. This indicates that all the services are utilized more than once.

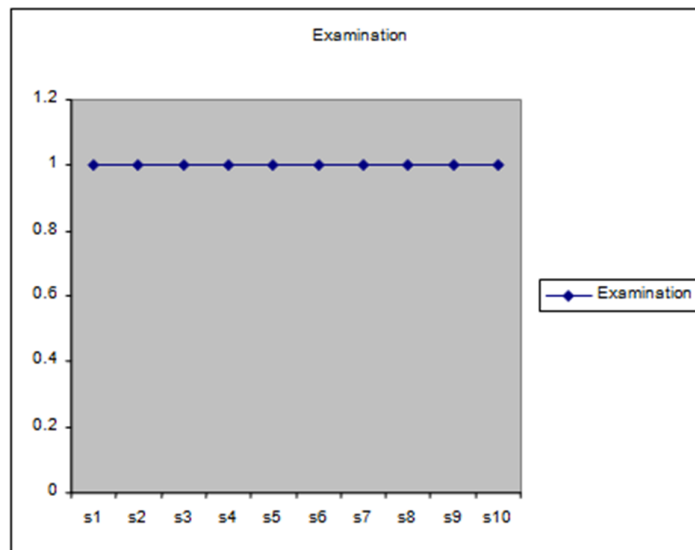


Figure 4. Examination operation reusability graph

The above mentioned figure indicates the reusability of various services in a single process called Examination. These services are independent and participating in a process based on requirements.

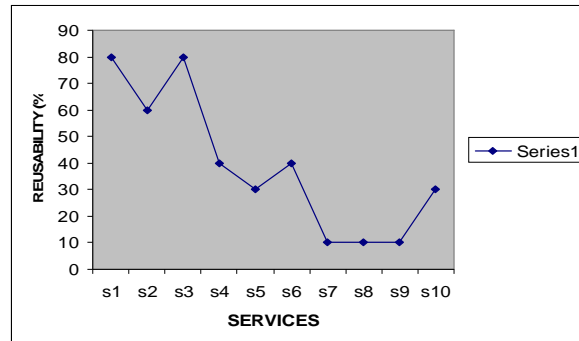


Figure 5. Percentage of Service reusability

Figure 5 explains the reusability factor of various services with different processes in percentage.

## FINDINGS

1. The results shown in the graph describes that all the services are having more than 50% reusability.
2. Not even a single service is defined with a zero reusability measurement which indicates that all the services are utilized by more than one consumer.
3. 50% services are completely reusable in nature where in they have more than 90% measurement.
4. There are many operations present with each service. This analysis reveals that the reusability of a single operation may also turn the whole service reusable with many applications.
5. Some services are repeatedly used with many processes. The form filling service considered for the analysis was used by all the processes such as examination, placement, admission etc.
6. The reusability of the services proves that the services are not only developed for current requirements and also for unknown future requirements.
7. The performance analysis provides performance analysis among the similar services. This helps the user to have the alternative services with similar or near to expected performance.
8. The service should be functionally rich. To have a highest degree of guaranteed reuse, the services should be packed with a complete range of functionality. The performance and the modularity prove that the functional services are reused well.
9. It is understood that the Service description mismatch is a mismatch between the consumer's requirements and description of the given service.
10. The reusable services make the application environment simple and cost effective. As the services are utilized by more than one application environment, the service creation cost is reduced from the complete process choreography.

## CONCLUSION

The above-mentioned analysis proves that the implementation of SOA provides higher reusability and service sharing among different consumers. Technical implementation in our Indian educational system faces barriers like grants, government policies, hierarchical structure, etc. This kind of open services may help the educational institutions overcome the barriers and enable



service sharing and knowledge enhancement. As a further development, the same testing can be done with a wider set of services and with accuracy.

## REFERENCES

- Arun Sharma, Rajesh Kumar & P.S. Grover, "A Critical Survey of Reusability Aspects for Component Based Systems", World Academy of Science, Engineering and Technology 33, 2007.
- Ann Rockley, with Pamela Kostur and Steve Manning, "Managing Enterprise Content: A Unified Content Strategy" available at [http://www.managingenterprisecontent.com/myweb/images/MEC\\_Chapter\\_2.pdf](http://www.managingenterprisecontent.com/myweb/images/MEC_Chapter_2.pdf)
- Thomas Erl, "SOA Principles of service Design", Pearson Education 2009, pp.35-38.
- A. Khoshkbarforoushha, P. Jamshidi, F. Shams, "A Metric for Composite Service Reusability Analysis", WETSoM'10, May 4, 2010, Cape Town, South Africa, ACM 978-1-60558-976-3/10/05.conference on Enterprise Computing, E-commerce and E-services.
- Service-Oriented Architecture in Education Sector" (2009), " *IJCSNS International Journal of Computer Science* No. 5, pp. 301-305.
- A. Khoshkbarforoushha, P. Jamshidi, F. Shams, "A Metric for Composite Service Reusability Analysis", WETSoM'10, May 4, 2010, Cape Town, South Africa, ACM 978-1-60558-976-3/10/05.
- Binghu Shim, Siho Choue, Suntae Kim, Sooyong Park, "A Design Quality Model for Service Oriented Architecture", 2008 15thAsia Pacific Software Engineering Conference, 1530-1362/08, IEEE.
- Si Won Choi and Soo Dong Kim, "A Quality Model for Evaluating Reusability of Services in SOA", 10th IEEE Conference on E-Commerce Technology and the fifth IEEE conference on Enterprise Computing, E-commerce and E-services.
- Sang hun Oh, Hyun Jung La and Soo Dong Kim, "A reusability evaluation Suite for Cloud services", 978-0-7695-4518-9 /11, 2011, IEEE.
- Arun Sharma, Rajesh Kumar & P.S. Grover, "A Critical Survey of Reusability Aspects for Component Based Systems", World Academy of Science, Engineering and Technology 33, 2007.