

## A Framework for Automating Transcript Processing

*Esingbemi P. Ebietomere and Godspower O. Ekuobase*

Department of Computer Science, University of Benin, Benin City, 300001, Nigeria.

### *Abstract*

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*Transcript, as it applies to the educational sector, is an academic summary of a student's stay in an academic institution. Transcript processing in Nigeria tertiary institutions is unnecessarily delayed due to high human involvement in the process. This has resulted in many applicants losing job, scholarship and admission opportunities. We argued that automating this process is a panacea and established that Service Orientation is most excellent for this automation. Consequently, we proposed a novel Web Services Architectural Framework as guide to realizing an Automated Transcript Processing System that is convenient, accurate, reliable, efficient, and secured.*

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**Keywords:** Transcript processing system, Software Automation, Service Orientation, Software architecture.

### 1.0 Introduction

A Transcript is a copy of a students' academic record, which contains all courses taken, all grades received and all honours or degrees conferred on the student during the period of studentship [1, 2]. It is an academic summary of a student's stay in an academic institution. It can be seen as a proof of graduation and as such, a key document to the furtherance of a student's chosen career or academic pursuit. It is therefore a vital document to the student, and any institution that may be interested in the student's academic history.

Most Nigerian tertiary institutions process their transcript manually with full human involvement while others involve computers at some points and mistake such process for automation. In any case, academic transcript processing in Nigeria tertiary institutions is herculean with its associated problems elicited as follows:

- **Inefficiency:** Due to the excessive human involvement in the current transcript processing system delays are inevitable. That a transcript processing activity may take weeks or even months is no news but a regular occurrence.
- **Poor Security/Safety:** Transcripts are confidential documents and should not be seen by applicants or unauthorized persons or bodies, but in this manual or computer aided system we observed that the reverse is often the case; the applicants may be the one taking the documents from one office to another. Besides, the relevant data source for transcript processing is exposed to tampering, theft, wilful or accidental destruction.
- **Inaccuracy:** Errors are inevitable where human involvement is excessive, causing data to be incomplete and/or inaccurate.
- **Poor reliability:** Since humans are excessively involved in the present processing systems, the integrity of the transcript is in serious threat because of the problem of corruption and forgery.
- **Storage limitation:** A transcript is a lifetime document. With increasing number of students, increasing physical storage is inevitable and doing this is quite expensive in both cost and physical storage space.
- **Stress:** This factor affects both the persons involved in the transcript processing system and the applicants. These processes are usually hectic, rigorous, cumbersome and back-breaking. The applicants most often than not are also put through the stress of processing as well and are often compelled to be physically present to apply for their transcript.

This has culminated in many applicants losing job, scholarship and admission opportunities.

Nigeria tertiary institutions therefore need a transcript processing system that CARES i.e. Convenient, Accurate, Reliable, Efficient and Secure.

We are however aware of some online transcript processing systems which some Nigerian Universities like the Federal University of Technology Owerri (FUTO) have adopted. Here, students and alumni from anywhere in the world can apply for transcript online and have it sent to them in any part of the world. This system only addressed the issue of convenience on the

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Corresponding author: Ekuobase G.O. E-mail: godspower.ekuobase@uniben.edu, Tel.: +2348064951845

part of the applicant where the physical presence of the applicant is not necessarily required. It has nothing to do with the processing of the transcript – the process of gathering, summarising and reporting student’s academic performances during his/her period of studentship in the institution.

We noted that the huge human involvement in the activities of transcript processing is a root cause of the problems associated with transcript processing in Nigeria. Invariably, automating transcript processing in Nigerian tertiary institutions is a sure panacea to building a transcript processing system that CARES; for automation eliminates to the highest possible level, the amount of human involvement in a data processing system.

We noted that for the automated transcript system to be acceptable and sustainable, it has to be in strong alignment with the traditional practice of processing transcript in the various tertiary institutions which however vary from one institution to another. The traditional way of processing transcript in most tertiary institutions in Nigeria is elicited as follows:

1. Applicants make request for transcript at the cash office (Bursary). The applicant supplies information such as Degree (DG), Matriculation number (MN), Session Graduated (SG), Beneficiary Name (BN), Beneficiary Address (BA), and Mode of Delivery (MD).
2. The MN, BA and MD are sent to the post master systems manually for postage billing from Bursary.
3. The Post Master bills the applicant considering the BA and MD and returns the MN, BA and postage charge to the Bursary.
4. The student makes payment.
5. The cash system (Bursary) issues an invoice with a unique number (TN), student’s particulars and expected delivery date.
6. The cash system sends student’s TN, MN, SG, DG, BN and BA to the Examinations and Records unit for processing of transcript.
7. The transcript is created and sent to the students appropriate Faculty for validation
8. If the document is correct, it is validated, authorized and sent back to the Examinations and Records unit. If there are errors, it is corrected before validation.
9. The Examinations and Records unit prepares the final transcript and sends it for posting to the appropriate BA.

Automating this process for CARES is non-trivial, considering the continuous restructuring of Nigeria tertiary institutions as a result of expansion which normally result in the creation of new programmes within departments, splitting and creation of new departments, faculties, colleges and schools; increasing student population and varying authentication checks. Besides, the convenience property demands that the automated system be interoperable.

This paper proposes a Web services architectural framework to realize an acceptable and sustainable transcript processing system that CARES; for tertiary institutions in Nigeria.

## **2.0 Proposed Framework for Automated Transcript Processing System that CARES**

Service Orientation is the most excellent approach to the design of automated systems [3]. In computing, the majority of such solutions have been created with a common approach of identifying the tasks to be automated, defining their requirements, and then building the corresponding solution logic. This has been an accepted approach to achieving tangible business benefits through the use of technology and has been successful at providing a relatively predictable return on investment. The ability to gain any further value from these applications is usually inhibited because their capabilities are tied to requirements and processes. When new requirements and processes come our way, we are forced to either make significant changes to what we already have, or we may need to build a new application altogether.

In the latter case, although repeatedly building “disposable application” is not an excellent approach, it has proven itself as a legitimate means of automating business processes and unveiled some useful lessons. Some of these lessons are:

- Solutions can be built efficiently because they only need to be concerned with the fulfilment of a narrow set of requirements associated with a limited set of processes.
- The systems analysis effort involved with defining the process to be automated is straight forward. Analysts are focused only on one process at a time and therefore only concern themselves with the entities and domains associated with that one process.
- Solution designs are tactically focused. Although complex and sophisticated automation solutions are sometimes required, the sole purpose of each is to automate just one or a specific set of processes. This predefined functional scope simplifies the overall solution design as well as the underlying application architecture.
- The project delivery lifecycle for each solution is streamlined and relatively predictable. Although software development projects are notorious for being complex endeavours, riddled with unforeseen challenges, when the delivery scope is well-defined (and does not change), the process and execution of the delivery phases have a good chance of being carried out as expected.
- Building new systems from scratch allows organizations to take advantage of the latest technology and advancements. However, the IT marketplace progresses every year to the extent that we fully expect technology we use to build solution logic today to be different and better tomorrow. As a result, organizations that repeatedly build

disposable applications can leverage the latest technology innovations with each new software development project. These and other characteristics of traditional solution delivery provide a good indication as to why this approach has been so popular. Despite its acceptance, though, it has become evident that there are still needs for improvement; as discussed below [3]:

**It Can Be Highly Wasteful** – the creation of new solution logic in a given enterprise commonly results in a significant amount of redundant functionality. The effort and expense required to construct this logic is therefore also redundant.

**It is not as efficient as it appears** – because of the tactical focus on delivering solutions for specific process requirements; the scope of software development projects is highly targeted. Therefore, there is the constant perception that business requirements will be fulfilled at the earliest possible time. However, by continually building and rebuilding logic that already exists elsewhere, the process is not as efficient as it could be if the creation of redundant logic could be avoided.

**It Bloats an Enterprise** – each new or extended application adds to the bulk of an IT environment's system inventory. The ever-expanding hosting, maintenance, and administration demands can inflate an IT department in budget, resources, and size to the extent that IT becomes a significant drain on the overall organization.

**It Can Result in Complex Infrastructure and Convoluted Enterprise Architectures** – having to host numerous applications built from different generations of technologies and perhaps even different technology platforms often requires that each will impose unique architectural requirements. The disparity across these traditional applications can lead to a counter-federated environment, making it challenging to plan the evolution of an enterprise and scale its infrastructure in response to that evolution.

**Integration Becomes a Constant Challenge** – Applications built only with the automation of specific business processes in mind are generally not designed to accommodate other interoperability requirements. Making these types of applications share data at some later point usually result in integration problem.

#### **The Need for Service-Oriented**

After repeated generations of traditional distributed solutions, the severity of the previously described problems has been amplified. This is why service-orientation was conceived. It very much represents an evolutionary state in the history of information technology (IT) in that it combines successful design elements of past approaches with new design elements that leverage conceptual and technology innovation.

Generally, service orientation has to its merit the following design characteristics[3]:

- Increased consistency in how functionality and data is represented
- Reduced dependencies between units of solution logic
- Reduced awareness of underlying solution logic design and implementation details
- Increased opportunities to use a piece of solution logic for multiple purposes
- Increased opportunities to combine units of solution logic into different configurations
- Increased behavioural predictability
- Increased availability and scalability
- Increased awareness of available solution logic

When these characteristics exist as real parts of implemented services, they establish a common synergy. As a result, the complexion of an enterprise changes as the following distinct qualities are consistently promoted:

**Increased Amounts of Agnostic Solution Logic** – within a service-oriented solution, units of logic (services) encapsulate functionality not specific to any one application or business process. These services are therefore classified as agnostic and reusable IT assets.

**Reduced Amount of Application-Specific Logic** – Increasing the amount of solution logic not specific to any one application or business process decreases the amount of required application – specific logic. This blurs the lines between standalone application environments by reducing the overall quantity of standalone applications.

**Reduced volume of Logic Overall** – the overall quantity of solution logic is reduced because the same solution logic is shared and reuses to automate multiple business processes.

**Inherent Interoperability** – Common design characteristics consistently implemented result in solution logic that is naturally aligned. When this carries over to the standardization of service contracts and their underlying data models, a base level of automatic interoperability is achieved across services.



**Client Application** – this is the service solution that helps initiates the transcript processing. The applicant is unaware of the various service solution involved except the one it interacts with; which in this case is the CashServiceSolution. It holds the interface where the applicants fill-out the necessary details pertaining to their request and effects payment as well. This service solution should be on the institutions’ portal.

**Cash Service Solution** – this service solution interacts with the Exams and Records Service Solution, Client Application, and the Postage Service Solution. It confirms if the applicant is eligible for transcript, be it partial or full. It also sends details of payment billing to the Postage Service solution for postage billing and adds the transcript processing charges to activate payment module that enables the applicant effect payment in the Client Application. Besides, it interacts with the third party payment solution like Banks and other electronic payment solutions. It is also responsible for sending feedbacks to applicants in the form of e-mail or sms about transaction states.

**Exams and Records Service Solution** – this service solution interacts with the Cash Service Solution, Faculty/College Service Solution, and the PostageService Solution. It notifies the Cash Service Solution on the eligibility of an applicant for transcript because it has a database holding the results of students. It also allows the results it holds be compared with that of the Faculty/College Service Solution for verification and validation; after which it can append the registrar’s digital signature. More so, it alerts the Postage Service Solution on the readiness of transcript for postage.

**Faculty/College Service Solution** – this service solution interacts solely with the Exams and Records Service Solution. It allows the results it holds in its database be compared with that in Exams and Records Service Solution for verification and validation to ensure consistency. Should there be inconsistency between the result held in the Exams and Records Service Solution’s database and that of the Faculty/College Service Solution’s database; an appropriate error message is sent to notify the appropriate problem handler. Where consistency is established, the Dean’s digital signature is appended.

**Postage Service Solution** – this service solution interacts with both the Cash Service Solution and Exams and Records Service Solution. It sends transcript to the applicants via e-mail and sms. This service solution can interact with a third party postage solution in case a hard copy of the transcript is needed.

If the framework shown in Figure 1 is faithfully implemented, we will realize a transcript processing system that behaves as follows:

1. The applicant makes a transcript request through the interface made available through the Client’s application to the Cash Service Solution. Here, the applicant fills necessary details such as Degree (DG), Matriculation number (MN), Session Graduated (SG), Beneficiary Name (BN), Beneficiary Address (BA), and Mode of Delivery. This information is wrapped and sent to the Cash Service Solution.
2. The Cash Service Solution routes this information by message parsing to the Exams and Records Service Solution to check if the applicant is eligible for a transcript.
3. Exams and Records Service Solution returns the information with a message, telling the Cash Service Solution if the applicant is eligible for transcript or not.
4. If the Student is eligible for transcript, the details filled out by the applicant is sent to the Postage Service Solution. Otherwise, an error message making an appropriate complain is displayed.
5. The Postage Service Solution sends the appropriate payment billing message to the Cash Service Solution.
6. The Cash Service Solution makes available to the applicant an invoice. With this invoice, the applicant knows the exact amount to pay and makes the payment.
7. Payment is made by the applicant via the interface made available by the Client Application.
8. On alert of payment by the applicant, the CashService Solution triggers Exams and Records Service Solution to commence processing the applicant’s transcript.
9. Exams and Records Service Solution sends the applicant’s result to the Faculty/College Service Solution which also holds the applicant’s result for verification and validation.
10. The Exams and Records System on receiving the message, sends a message to the Faculty/College System requesting result verification/validation. If the results held by both the Exams and Records Service Solution and the Faculty/College Service Solution is consistent, validated and digitally signed transcript is sent back to Exams and Records Service Solution.
11. Exams and Records Service Solution sends the transcript to the Postage Service Solution for Delivery.
12. The Exams and Records Service Solution also sends a delivery confirmation to the Cash Service Solution.

It is pertinent to note that all activities involved in the entire system are automatic and as such does not involve human in its transcript processing activities. With this, a sustainable transcript processing system that CARES is realisable and applicants

can apply for and get their transcripts delivered at specified destination in real time, round the clock. The framework is in strong alignment with Service Orientation principles.

#### 4.0 Conclusion

We noted that the current transcript processing systems in Nigerian Tertiary Institutions may lack CARES (Convenience, Accuracy, Reliability, Efficiency and Security); and this is due to the huge human involvement in the transcript processing activities. A clear panacea to removing human involvement from transcript processing is by automation. We noted that the traditional way of building automated applications is inferior to the service oriented automation capability [3]. At the heart of Service Orientation is Web Services [4]. Being a novel software development paradigm, we proposed a Web Services Architectural Framework hitherto not existing/exposed to the best of our knowledge, to help software developers realize a sustainable Automated Transcript Processing System that is convenient, accurate, reliable, efficient, and secured. This system is presently under development as part of an institution's wide automation system for result processing in the Department of Computer Science, University of Benin, Benin city; using University of Benin as case study.

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