World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 4.326

A DOCUMENT INTERCHANGE FRAMEWORK FOR TERTIARY INSTITUTIONS

Wilson Nwankwo*[1], Olanrewaju Babatunde[2] and Olayinka Tosin

[1]Ph. D., MCPN, PMP, RMP Department of Computer Science & Information Technology Wellspring University Benin-City, Nigeria.

[2]M. Sc, Department of Computer science & Information Technology Wellspring University Benin-City, Nigeria.

[3]M. Sc. Department of Computer science & Information Technology Wellspring University Benin-City, Nigeria.

Article Received on 28/06/2017 **Article Revised on 18/07/2017** **Article Accepted on 08/08/2017**

***Corresponding Author**
Wilson Nwankwo
Ph. D., MCPN, PMP, RMP
Department of Computer Science & Information Technology Wellspring University Benin-City, Nigeria.

ABSTRACT

In this paper we evolve a document interchange framework for tertiary institutions in Nigeria. This study follows an object-based qualitative approach. We examined the various processes and formats adopted by Nigeria's Tertiary Institutions when verifying and validating academic documents submitted to them by candidates enrolled in various academic programmes and for which such verification or validation lies with another tertiary institution. Analysis of the state of affairs revealed several problems associated with the process such as: delays, high cost of verification, student's unlimited involvement in the process, etc. To eliminate these problems, we proposed a uniform document interchange framework which could be adopted by the appropriate regulatory authorities (Federal Ministry of Education, National Universities Commission, National Board for Technical Education, National Council for Colleges of Education). With the proposed FRAMEWORK, each Institution could implement its Academic Information System in such a way that it will talk to or exchange requests and verification information directly by way of controlled handshaking with a system owned by another Institution through a coordinating message exchange service interface over a public network such as the Internet.

KEYWORDS: Document exchange, Interchange framework, XML, Academic data exchange, Document model

INTRODUCTION

Documents are central to the running of every organization whether or not profit-based especially tertiary educational institutions where many vital decisions may be taken by a party based on the presentation of the requisite document(s) by another party. What constitutes a document is usually a matter of specification or the requesting party (authority). These documents may come in different forms but must possess the very characteristics of a document. The term *document* may be applied to any discrete representation of meaning, but usually refers to something physical like one or more printed pages, or to a "virtual" document in electronic (digital) format. A document is the main information medium in the office and a key aid in the integration of office functions (Ananda, 1988). A document may contain a structured amount of data that can be exchanged between the originator and the recipient. A document consists of components, that is, the document profile, generic structures (logical and layout object classes), specific structures (logical and layout objects), styles (layout and presentation styles) and content portions.

Documents are sometimes classified as secret, private or public. They may also be described as a draft or proof. When a document is copied, the source is called the original. There are accepted standards for specific applications in various fields, such as:

- Academia: thesis, dissertation, paper, journal
- Business and accounting: invoice, quote, RFP, proposal, contract
- Law and politics: summons, certificate, license, gazette
- Government and industry: white paper
- Media and marketing: brief, mock-up, script.

A document is, in some respects, a product according to the STEP definition (Cutting-Decelle & Michel, 2003). It is a transitional and changing object defined within a precise stage of the Project Life Cycle. In general, a document is related to other elaborated documents of the Project Documentary Database. A Document has one or many authors. It is described by general attributes such as a Code, an Index, a Designation, a date of creation and its Author(s). A list of updated versions also keeps a record of any amendments made to the document. A document may have an associated indexing system.

Document Interchange

Interchange of documents is an essential part of corporate communication. Communication involves the exchange of data, information or knowledge. Communication may be direct or indirect communication (Gunther Krönert, 1990). Direct communication may include discussions which allow a spatial distance between the parties but not a temporal one while indirect communication allows both spatial and temporal distances. In theoretical interpretation indirect communication may take the form of document exchange.

In many situations, documents are the main source for the interaction between personnel users in this administrative system. A large amount of various kinds of forms and documents need to be prepared as paper backup on the shelf in a real educational administration environment (Tao and Mao, 2008).

However, exchanging information with another party especially in paper-based format is susceptible to errors, easy distortion, and even time consuming. A typical example is where some vital documents sent from one party to another are lost in transit. This could mean substantial losses to the business of the affected party, and where such information is so sensitive and highly confidential; it may pose serious security risks when it gets into the hands of the wrong person.

In order to boost efficiency and simplify the workflow in educational administration, electronic data exchange has shown enormous potentials in the last decade. Due to the advancement in the direction of electronic document exchange, standards have been developed over the years. For instance, the document interchange between open systems has been standardized by office document architecture (ODA) and office document interchange format (ODIF) (Gunther, 1990).

Data Interchange Principles

A data interchange framework may be designed based on the following principles and architectures (Andreica et al., 2014)

1. Agent based system development, which is used for the communication between the agents within the multi-agent system, in the form of FIPA-ACL (FIPA web) messages.
2. Agent-oriented methodologies such as Gaia (Wooldridge et al, 2000) used for MAS development influence interoperability within the system.

3. Ontologies are used for achieving semantic interoperability in the multi-agent educational system. They are powerful tools for sharing knowledge sources in a scalable, adaptable and extensible manner and for reaching semantic interoperability among heterogeneous, distributed systems.
4. Multi-agent architecture is used for designing the data exchange model proposal in order to benefit from the advantages that agent based technology offers: decentralization, extensibility, robustness, maintainability, flexibility (Weiss, 1999).
5. The knowledge layer is based on the Conceptual Knowledge Processing paradigm, which makes use of concept lattices, that is, knowledge maps displaying concepts and their hierarchies, with a clear semantic and a very high expressivity. They are based on Formal Concept Analysis (Ganter et al, 2005) and the mathematical theory of concepts and their hierarchies are widely accepted standard of knowledge processing and representation.
6. Open Internet of Things: the "Utility/Application Plane" and "Virtualized Plane" layers provide a flexible framework for information communication and exchange including cases of cloud hosted data (OpenIoT, 2013).

Office Document Architecture (ODA) Standard

The ODA standard describes an abstract view of an office document and a document processing model as well as an interchange format of a document. The ODA standard defines three kinds of document forms: a processable form with logical structures created after an editing process; a formatted form with layout structures produced by a formatted process; and formatted processable form with both logical and layout structures also produced by a formatted process. An imaging process takes a formatted or formatted processable form and produces a final document. ODA can specify the form of an encoded octet stream called the Office Document Interchange Format (ODIF). Security features of ODA include confidentiality, integrity, authenticity and non-repudiation of origin. A model is developed which describes how the documents are structured. The standards refer to the model as ODA while ODIF defines the coding for documents to be interchanged electronically, which can be derived from the model developed. Both ODA and ODIF are standards under the ISO/IEC 8613-1:1994 (ISO, 2006).

Development of the ODA started in late 1989 and has reviewed up to 2006, and though useful, however, it has been superseded by other technologies such as: Extended Mark-up Language (XML), Extensible Stylesheet language (XSL), Open Document, Office open

XML, etc. We shall restrict our discussion to XML and XSL as many other standards such as Open document and Office open XL are based on XML and XSL.

Extended Mark-up Language (XML)

XML is the most popularly used format or language for data exchange and integration between enterprise systems, web applications or services within organizations, and accordingly, integration of XML data has become an important research problem.

XML's development started with a group codenamed "SGML Editorial Review Board" that later became XML Working Group under the auspices of the World Wide Web Consortium (W3C) in 1996. According to W3C, the design goals of XML as a specification are that.

- It shall be straightforwardly usable over the Internet
- It shall support a wide variety of applications.
- It shall be compatible with SGML.
- It shall be easy to write programs which process XML documents.
- The number of optional features in XML is to be kept to the absolute minimum, ideally zero.
- XML documents should be human-legible and reasonably clear.
- The XML design should be simple and concise to prepare.
- Terseness in XML mark-up shall be of minimal importance.

As the technology continues to advance, studies have been undertaken to explore other areas of application. Abiteboul et al.(2000) and Bourret (2000) both agreed that XML definitions can be used to define databases and relevant algorithms. XML technology as the emerging standard for exchanging and presentation of data over the Internet has become an important business initiative in the 21st century (Opara & Srivastava, 2003). XML is important for achieving greater efficiencies and improving organization's information exchange and processing undertakings. Moreover, XML is important as a competitive technological tool in global e-business. XML deployment strategies are expected to continue to grow in complexity as e-transaction processing in the banking-financial services industry leans on IT to ensure compliance and maintain an above average returns on investments (Dodds, 2000).

Integrating XML-based data systems

Data integration in XML involves reconciliation at different levels (Le et al, 2006). These levels are: schema level, and instance level. At the schema level, different representations of

the same entity must be reconciled whereas at the instance level, more work is done to ascertain whether or not the different objects from different sources represent the same real-world object. XML is a key technology for enterprise system integration strategy that enables integration of enterprise IT systems and sharing of business processes standards as it can be implemented across the entire enterprise. XML implementation will lead to cost savings, interoperability and new opportunities for businesses (Opara and Srivastava, 2003).

Extensible Stylesheet Language (XSL)

XSL is often regarded as a family of languages that are used to transform and render XML documents. Initially developed by the XSL Working Group in W3C under a common name XSL, the specification has three parts

- XSL Transformation (XSLT) - an XML language used to transform XML documents;
- XSL Formatting Objects (XSL-FO) - an XML language used to specify visual formatting of an XML document;
- XML Path Language (XPath) – this is a non-XML language associated with XSLT. It is used for addressing specific parts of an XML document.

Accordingly, XSL may be used to represent: any of the species specified above; namespace prefix for the XSLT namespace; and as suffix in file names of files containing XSLT stylesheet modules. XSL is a widely used technology in document-oriented systems.

Other models and quai-standards

Aside XML and its derivatives, there are some other standards or quasi-standards that are worthy of note. The Learning Objects Model (LOM) and the SCORM standard have improved in various directions: personalized adaptive learning frameworks based on user profiles (Arroyo et al, 2006); thus enhancing universal interoperability layer for educational networks with Simple Query Interface (SQI). SCORM is an acronym for “Sharable Content Object Reference Model”. “Sharable Content Object” implies that SCORM is all about creating material that can be shared across different systems. SCORM defines how to create “sharable content objects” or “SCOs” that can be reused in different systems and contexts. The “Reference Model” reflects the fact that SCORM isn’t actually a standard but a reference to existing standards that tells developers how to properly apply them.

The Systems Interoperability Framework (SIF) Association has also achieved relevant results, proposing specifications for event reporting, data provisioning, messages and agents.

Among major drivers of messaging standards are: Organization for the Advancement of Structured Information Standards (OASIS), Internet engineering task force (IETF) that developed the Application statement 2 (AS2) specifications, RosettaNet, etc.

OASIS is an international open standards consortium known for their popular specifications:

a. **Service Component Architecture (SCA):** a set of specifications that describe a model for building applications and systems using a Service-Oriented Architecture (SOA). "SCA extends and complements prior approaches to implementing services, and SCA builds on open standards such as Web services. SCA is based on the idea that business function is provided as a series of services, which are assembled together to create solutions that serve a particular business need. These composite applications can contain both new services created specifically for the application and also business function from existing systems and applications, reused as part of the composition. SCA provides a model both for the composition of services and for the creation of service components, including the reuse of existing application function within SCA compositions. SCA aims to encompass a wide range of technologies for service components and for the access methods which are used to connect them" (OASIS, 2015).
b. **Service Data Objects (SDO):** This is designed to simplify the way in which SOA applications handle data. With SDO, programmers can uniformly access and manipulate data from heterogeneous data sources, including web services, relational databases, XML data sources, enterprise information systems, etc.

Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI) has remained an emerging concept over the last two decades with evolving complexity in secure data delivery and data integrity. EDI is a computer-to-computer exchange of documents in a standard electronic format. Simply put, It is a step away from the conventional paper-based exchange of documents involving the substitution of the conventional way of information sharing whereby one party sends information directly or indirectly to another, with an electronic sharing medium. However, EDI must be distinguished from other electronic means such as email, social media platforms, workgroups, etc. Unlike many electronic information exchange platforms or systems, EDI involves a more structured exchange between two or more electronic devices and applications. The "structure" in this aspect has to do with an agreed standard and format which must be predefined and employed in encoding the information to be exchanged for

there to be a successful handshaking. The merits of EDI include reduction in document processing cost, increased processing speed, reduction in errors, low resource consumption, enhanced relationships among the users to mention but a few. According to Adams et al.(2002) , the EDI was proposed for standardizing business information exchange and has various formats or species of it in use. The EDI uses different standards such as: ANSI X.12, XML (cXML, xCBL, Open Trans, UBL). XML is a subset of the Standardize Generalized Mark-up Language [SGXL].

Document Exchange in Nigerian tertiary institutions

It may be safely submitted that exchange of vital information across tertiary institutions in Nigeria is next to zero as there is no formally established information sharing resource or centre that interfaces or controls information exchange among tertiary institutions. On that ground, it is often difficult to exchange vital information such as the verification and validation of academic documents such as certificates, statement of results, etc. The odd practice still remains that a student who seeks admission in one tertiary institution would be required to initiate a process to have his previous academic profile or transcript processed by his former institution and forwarded usually by post to the new institution to which he/she seeks admission. For instance, a graduate of University of Lagos who wishes to undertake a post-graduate study at the Federal University of Technology Owerri will be required to initiate a process to have his transcript processed and sent by University of Lagos. This often creates bottle necks as well as confidentiality issues. Since the student must pay for the transcript, it subjects the entire process of validation and verification to manipulation. To this end the very purpose of verification may be defeated. Having regard to the lapses in sharing critical information, this study proposes a very cost-effective and light-weight framework that could be used to overcome these challenges.

OBJECTIVES OF THIS STUDY

This paper is aimed at providing a document interchange structure (DIS) that will:

a. Provide a clear, structured, coordinated and uniform document interchange specification that could be easily implemented across all tertiary institutions in Nigeria.
b. Define and flexible electronic document exchange cycle that would eliminate the bottlenecks associated with the existing crude system.
c. Define various layers of a document interchange framework and how these layers will operate regardless of the implementation approach;

d. Improve the credibility of academic document verification process by eliminating: the usual costs on students, and restricting students' involvement in the process;
e. Afford every tertiary institution a timely access to documents originating from another institution irrespective of location whenever required in respect of a student's academic history;
f. Enthrone consistency, standardisation and predictability across all tertiary institutions in the process of verification of academic documents;
g. Contribute to the quality assurance and continuous improvement drives of relevant educational institutions and in Nigeria;
h. Assist the various regulators of educational institutions in enthroning conformity in vital operations of Universities, Polytechnic's, Colleges of Education and other regulated institutions.

METHODOLOGY

An extended qualitative descriptive approach was adopted in this study. The extension to the qualitative descriptive approach is drawn from the fact that it is possible to enhance or extend the meaningfulness of the qualitative approach by infusing a light flavour of object-oriented analysis. The reason behind this extended approach is due to the premium we placed on simplicity and clarity on the component specifications to be defined. Prior to specifying the component variables, observation and routine operational investigation were the major data gathering methods employed. In addition, the residual knowledge of the authors in the academic environment also played an important role. Employing the object-oriented analysis, we identified the actors in the existing system.

Actors

Academic officer: this actor represents any authorized officer of the requesting University who may notify prospective students regarding their verifying documents/credentials.

Student: prospective student.

Certifying officer: Any authorized officer of the provisioning University who may receive or initiate the process of processing/verifying student's academic profile/transcript.

Accordingly, a model of the existing system is presented in Figure 1. The diagram in Figure 1 shows the various Actors and their actions in a conventional verification of a student's

credentials. First, the Requesting Institution (RI) through an authorized officer, notifies a prospective student to make necessary arrangements that would crystallize into having his academic transcript or previous academic profile sent to the RI. The student then makes contact to the Verifying or Certifying Institution (CI) that is, his former Institution where he must have undertaken a course of study. This contact often involves payment of requisite fees for the processing and onward transmission to the RI. In some cases, the student may be handed the verified document which he would personally send to the RI.

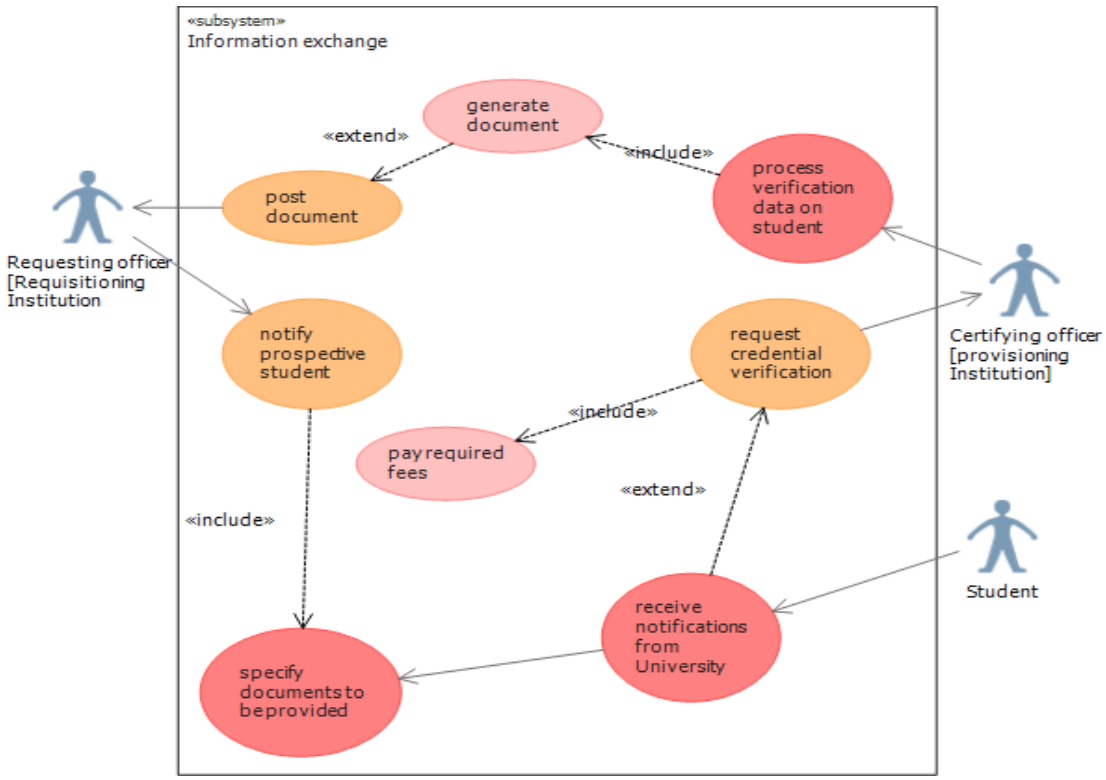

Figure 1: Use case diagram of the existing system.

RESULT AND DISCUSSION

This section presents the following interrelated concepts or message specifications that constitute the framework for the information exchange procedures. The framework is wholly based on.

a. XML component specification, and/or
b. Extended Schema Definition (XSD) specification.

The XML component message specifications are captured in a tabular format for simplicity and contain the following XML details:

a. Component field properties
b. Field validation rules

c. Possible Error code(s)and Error message associated with each component field
d. Dynamic properties of the component field dependent on the given operation on the field.

Categories of XML Component message specification

This study has designed the following message specifications

1. Request for Information (RFI) message
2. Feedback on Request for Information (FRI) message
3. Cancel Request for Information (CRI) message
4. Delete Request for Information (DRI) message
5. Delete Confirmation Message (DCM)
6. Applicant Transcript Information(ATI) message

In each message specification, we adopted the dot notation commonly used in the XML schema and field definitions. Each specification contains a set of fields and each field is defined using one or more three-letter codes. The field specification is:

<PARENT FIELD>.<CHILD FIELD>[.<CHILD FIELD$_I$>…<.SUBFIELD$_N$>]

That is, where a field is a combination of more than one three-letter fields, the first field is the parent field, the next is the child field and the next is the grand-child field…. For instance, in RFI.PRG.NAM, "RFI" is the parent field and represents the main message document; "PRG" represents an academic programme specification and "NAM" represents the programme name field.

Request for Information message (RFI)

The RFI message specification provides an initial message generated by the requesting institution (RQI) to the servicing institution (SVI). The content of the RFI is shown is Table I. The Message contains basic details of the student (the subject of the message) and goes through the DCI interface to the Tertiary Institution. The file is in the format:

<USER>_RFI_<REGISTRATION NUMBER>.XML

The <user> component represents the identity of the authorized user who is making the request. The <user> for each tertiary must be an authorized personnel perhaps saddled with the responsibility of verification and validation of prospective student's credentials. RFI prefix indicates that the message is a "request for information" message; the

REGISTRATION_NUMBER represents the applicant/student's registration or matriculation number as documented by the SVI.

Table I: Request for information (RFI) message.

Component Message	XML field	Description	Mandatory	Field specifications
RFI	RFI.PRG.NUM	Registration number of student	Yes	Maximum length of 12 characters
RFI	RFI.DAT	Request date	Yes	Date as dd-MM-yyyy
RFI	RFI.SVI.COD	SVI identification code	Yes	Maximum length of 3
RFI	RFI.SVI.NAM	SVI name	Yes	Maximum length of 30
RFI	RFI.PRG.NAM	Student's programme name	Yes	Maximum length of 4 digits
RFI	RFI.PRG.QUA	Student's programme qualification	Yes	Maximum length of 4 digits
RFI	RFI.PRG.CER	Certificate number of student's qualification	No	Maximum length of 15 characters
RFI	RFI.RQI.COD	RQI identification code	Yes	Maximum length of 3
RFI	RFI.SER	Request identification OR Serial number	Yes	Maximum length of 10

Feedback on Request for Information (FRI) message

This message specification is activated when the servicing institution receives a RFI message from a RQI. The FRI message is a response message and may either indicate one of five possibilities captured through the status (STA) field:

a. Request invalid (INV)
b. Request received and lodged (RRL)
c. Request under processing (RUP)
d. Requested information does not exist (RDE)
e. Request processed satisfactorily (RPS)

Table II shows the specification of the FRI. The feedback file pattern is in the format:

<USER>_FRI_<REQ.SER>.XML

Table II: Feedback on Request for Information.

Component Message	Field name	Description	Mandatory	Field specifications
FRI	RFI.PRG.NUM	Registration number of student	Yes	Maximum length of 12 characters
FRI	RFI.DAT	Request date	Yes	Date as dd-MM-yyyy
FRI	RFI.SVI.COD	SVI identification code	Yes	Maximum length of 3
FRI	FRI.DAT	Feedback date	Yes	Date as dd-MM-yyyy
FRI	RFI.STA	Request status	Yes	Maximum length of 3
FRI	RFI.SER	Request identification OR Serial number	Yes	Maximum length of 10
FRI	RFI.PRG.CER	Certificate number of student's qualification(where student registration number does/does not exist)	No	Maximum length of 15 characters
FRI	FRI.SER	Feedback message serial number	Yes	Maximum length of 10

Cancel Request for Information (CRI) message

This message specification is only activated when there is a need to cancel an earlier request sent from the RQI to the SVI. The CRI when delivered will automatically suspend the earlier RFI. The CRI must be defined so as to match the earlier message to which it is meant to nullify. Table III shows the various field included in the cancel request message specification. The file name specification is

<USER>_CRI_<REQ.SER>.XML

Table III: CRI specification.

Message	Field name	Description	Mandatory	Type
CRI	RFI.SER	Request identification OR Serial number	Yes	Maximum length of 10
CRI	CRI.DAT	Cancellation date	Yes	Date as dd-MM-yyyy

Delete Request for Information (DRI) message

The DRI is sent through the EDI controller from the RQI to the SVI to annul a message sent sometime in the past. The effect is that if the message is approved the said request will be flushed out of the system. There are two ways to this deletion. Where there is a central interface controller, then the approval of the deletion will be effected at such an interface

controller in accordance with predefined rules. However, where there is no intermediate controller the power to effect a deletion will reside at the side of the SVI. Table IV shows the various field included in the DRY message specification. The file name specification is:

<USER>_DRI_<REQ.SER>.XML

Table IV: DRI specification.

Message	XML field name	Description	Mandatory	Type
DRI	**RFI.SER**	RFI identification OR Serial number	Yes	Maximum length of 10
DRI	**DRI.DAT**	Delete request date	Yes	Date as dd-MM-yyyy

Delete Confirmation Message (DCM)

This Message is sent by SVI interface to the RQI as a feedback to an earlier DRI request from the RQI. The DCM is a confirmatory response that informs the RQI that the deletion of its RFI message is completed. The File name pattern is : <USER>_DCM_<REQ.SER>.xml Table V shows the DCM message specification.

Table V: DCM message specification.

Message	XML/XSD field name	Description	Mandatory	Type
DCM	RFI.SER	RFI identification OR Serial number	Yes	Maximum length of 10
DCM	DRI.DAT	Delete request date	Yes	Date as dd-MM-yyyy
DCM	DCM.DAT	Delete confirmation date	Yes	Date as dd-MM-yyyy
DCM	RFI.STA	Status of RFI	Yes	Maximum length of 3

Applicant Transcript Information (ATI) message

This message has larger size than other message specifications owing to the fact that it captures all atomic details about the academic history or profile of the applicant/student against whom request is made during his/her studentship in the SVI. The ATI is generated at the SVI system and sent to the RQI without any interaction with the applicant (student) against whom it is issued. In other words, the ATI is expected as the output of a RFI message. On successful generation and transmission to the RQI, a new FRI message is generated with

an updated status of RPS (Request Processed Successfully) for the original RFI message to which the ATI message is associated. The file name format for ATI message is:

<USER>_ATI_<REGISTRATION NUMBER>.XML

Table VI is a detailed specification of the ATI message.

Table VI: ATI message specification.

Message	XSD/XML Field	Description	Validation Rules/Mandatory	Error Message	
ATI	ATI.COM	Comments		N	
ATI	ATI.DAT	Date document was generated	Date must be in format: dd-MM-yyyy	Y	Wrong date format: date is invalid
			Check if this ATI already exists		The ATI already exists
ATI	RFI.SER	Serial number of initial request	Maximum length of 10. To be validated against the parent RFI request	Y	Invalid serial number
ATI	ATI.SER	Document serial number	Check if this ATI already exists	Y	The ATI message already exists
ATI	ATI.PRE	Document prefix	Must begin with STU	Y	Message is invalid
ATI	ATI.SVI.NAM	Issuer Institution/ SVI name	Maximum length of 70	Y	
ATI	ATI.SVI.ADD	SVI address	Maximum length of 70 & minimum of 10	Y	Address not valid
ATI	ATI.SVI.CIT	SVI City	Maximum length of 70	Y	City must be included
ATI	ATI.SVI.STA	SVI State	Maximum length of 2	Y	Invalid State
ATI	ATI.SVI.TEL	SVI Telephone	Maximum length of 20	Y	Invalid telephone code
ATI	ATI.SVI.ZIP	SVI zip code	Maximum length of 10	N	
ATI	ATI.SVI.EMA	SVI Email	Maximum length of 50	Y	Invalid email
ATI	ATI.SVI.CTY.COD	SVI country code	Maximum length of 3	Y	Invalid country

					code
ATI	ATI.SVI.END.DAT	Authorized endorsement date	Date must be in format: dd-MM-yyyy	Y	Invalid date
ATI	ATI.SVI.END	Authorized endorsement	Base 64 string that represents a signature	Y	Invalid endorsement
ATI	ATI.SVI.END.NAM	Name of authorized endorsee	Maximum length of 30	Y	Name cannot be empty
ATI	ATI.SVI.END.RAN	Rank of the authorized person endorsing the document	Date must be in format: dd-MM-yyyy	Y	The rank cannot be empty
ATI	APP.PRG.NAM	Applicant programme name	Maximum length of 20	Y	Invalid programme name
ATI	APP.PRG.DUR	Applicant programme duration	Maximum length of 10	Y	Invalid period
ATI	APP.PRG.DAT	Date of commencement of programme	Must be in format dd-mm-yyyy	N	
ATI	APP.PRG.CPL	Programme completion date	Must be in format dd-mm-yyyy	Y	Invalid date
ATI	APP.REG	Applicant registration number	Maximum length of 12	Y	Applicant's number is required
ATI	APP.TIT	Applicant title	Maximum length of 5	N	
ATI	APP.NAM	Applicant full name	Maximum length of 80	Y	Applicant's name cannot be empty
ATI	APP.ADR	Applicant contact address	Maximum length -120	Y	Address cannot be empty
ATI	APP.STA	Applicant state of origin	Maximum length of 2		
			Check reference with STA.TAB		Applicant's state of origin code incorrect
ATI	APP.CIT	Applicant city	Max length 20		
ATI	APP.BIR	Applicant date of birth	Must be in the format: dd-mm-yyyy	Y	Invalid date of birth
ATI	SEM.NAM	Semester name	Maximum length	Y	Invalid

			of 12		semester value
ATI	SEM.SES	Academic session	Maximum length of 9 and must be in format: dddd/dddd	Y	Invalid session
ATI	SEM.CRS.NAM	Course name	Maximum length of 20	Y	
ATI	SEM.CRS.COD	Course code	Maximum length of 7	Y	Invalid course code
ATI	SEM.CRS.UNI	Course unit	Maximum length of 1	Y	Invalid course unit
ATI	SEM.CRS.GRD	Grade obtained in a course	Maximum length of 1; must be a letter from set(A-F)	Y	Invalid grade
ATI	ATI.CUM	Cumulative Grade point average of student	Maximum length of 3	Y	Invalid number
ATI	ATI. CUM.CLS	Classification of applicant's grade	Maximum length of 15	N	Invalid label
ATI	ATI.REM	General remarks	Maximum length of 200	N	

Operational cycle message

The various specifications presented above are not employed or used simultaneously but are seen to follow an operational cycle. This operational cycle may also be called a message exchange cycle. The cycle begins with one institution (RQI) initiating a communication with another institution (SVI) via a RFI message. This messages when received is acknowledged by the SVI through a feedback response (FRI). A FRI message depicts one of many states of affairs as earlier discussed. Following a FRI, a new message in the form of CRI or a DCM may be initiated. Once conditions are satisfied, the SVI sends an ATI message to the RQI and the message cycle is terminated.

CONCLUSION

This paper is the first part of a study geared towards implementing an electronic data interchange framework and a model that support controlled exchange of structured information between tertiary institutions in Nigeria especially in the domain of verification and validation of students' previous academic performance claims which are usually required prior to admission into a higher academic degree/diploma programme. We have examined

various document exchange formats and XML and/or its derivatives have remained the most viable option. Having regard to the existing system of operation in verifying credentials we have developed specifications that can easily be implemented regardless of the electronic or computerized operating platform of any tertiary institution. The specifications are lightweight, simple, and easy to implement. It is envisaged that controlled information exchanged among tertiary institutions could be enhanced and extended further by adopting an organized framework as we have shown in this paper.

REFERENCES

1. Abiteboul S, Buneman P and Suciu D Data on the Web: From Relations to Semi-structured Data and XML, Morgan Kaufmann Publishers, 2000.
2. Adams S, Hardas D, Iossein, A and Kaiman C. BizTalk Unleashed, Sams Publishing Indianapolis Indiana, 2002.
3. Ananda A L "Document formatting for interchange between word processors". J Department of Information Systems and Computer Science. National University of Singapore, Kent Ridge, Singapore, 1988; 11(6).
4. Andreica A J, Czibulla G S, and Sacarea C "Designing General Architecture for Data Iterchange". International Conference on Web Information Systems and Technologies, 2014.
5. Bourret, R P "XML Database Products [online]", Retrieved from http://www.rpbourret.com/xml/, [Accessed 27 July 2017], 2000.
6. Cutting-Decelle, A F & Michel, J J "ISO 15531 MANDATE: a standardised data model for manufacturing management". International Journal of Computer Applications in Technology archive, 2003; 18(1): 43-61.
7. Dodds, L "Schema Round-up [online]", Retrieved from http://www.xml.com/pub/200/09/06/deviant.html/ , [Accessed 27 July, 2017], 2000.
8. Ganter B, Stumme G and Wille R Formal Concept Analysis - Foundations and Applications, Springer, 2005.
9. International Standards Organisation Revised Text of ISO 8613/DAD4, Information Processing — Text and Office Systems. Office document Architecture (ODA) and interchange format, 1994.
10. Krönert G "Importance of the ISO standard 8613 for document interchange Basic standard, functional standards, initial experience, benefits", Computer Physics

Communications. Elsevier Science Publishers B.V. (North-Holland), 1990; 61: 209-218 209.

11. Le, D X Rahayu J W and Pardede E "Dynamic approach for integrating web data warehouses", In Proceedings of International Conference on Computational Science and Its Applications, 2006; 207–216.
12. OASIS "Open CSA [online]", Retrieved from http://www.oasis-opencsa.org/sca/, [Accessed 28 July 2017], 2015.
13. Opara E and Srivastava M "Extensible Markup Language: An Enterprise Integration Web Delivery System". Communications of the International Information Management Association, 2003; 3(2).
14. OpenIOTOrg, "Open Internet of Things architecture [online]", Retrieved from https://github.com/OpenIotOrg/openiot/wiki/OpenIoTArchitecture, [Accessed 22 July 2017], 2013.
15. Sameshima Y and Kirstein P T Secure document interchange: a secure user agent. Computer Networks and ISDN Systems, Elsevier Science B.V., 1996.
16. Tao L and Mao W Intelligent Document Technology in University Educational Administration Management System. Proceedings of IEEE International Symposium on IT in Medicine and Education, 2008.
17. Weiss G E Multi-agent Systems: A Modern Approach to Distributed Artificial Intelligence, MIT Press, 1999.
18. Wooldridge M., Jennings N R and Kinny D "The Gaia Methodology for Agent-Oriented Analysis and Design". Journal of Autonomous Agents and Multi-Agent Systems, 2000; 3(3): 285-312.
19. W3C, "XML [online]", Retrieved from http://www.w3.org/TR/xml11/#charsets, [Accessed 22 July 2017], 2006.