Experience in E-learning through International Collaboration & Cooperation: A Case Study of the February - May 2007 Course in Introduction to Geographic Information System (GIS) Using Free and Open Source Software.

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Key Words: E-Learning, GIS, FOSS, QGIS, LMP, F2F

SUMMARY

This paper discusses the use of E-Learning in the delivery specifically of a course in Geographic Information System (GIS) using Free and Open Source Software (FOSS) called Quantum GIS (QGIS) and the GRASS Plug in. The learning management platform (LMP) used for the course delivery was adapted from "Moodle" (see http://moodle.org), an Open Source Software with GNU General Public License (GNU GPL). It was delivered by the Centre for Public Policy and Administration, University of Massachusetts, USA and represents a reasonable and relative new approach to the use of e-learning in GIS training and education to reach wider audience across the world including opportunity for participation from developing countries where competence in this area are either lacking and/or not sufficient. The successful nature of the course overall is strictly my view point as a participant in the course. Experience obtained from the course indicated that world-wide collaboration and cooperation among nations, faculties and communities of learners and tutors all over is not only possible but a reality.

It is therefore possible to use e-learning method for educational services delivery to quickly improve the educational profile of many universities, institutions and training centres across the world and especially in the developing countries. While problems related to universal service and universal access to ICTs (particularly, Internet) have been highlighted it should not been seen as major bottleneck in this era of information society and knowledge age. Development in e-learning for any course at all including GIS, Surveying, Geo-informatics etc should be seen fundamentally from those issues that helps and/or hinder actual delivery of the courses including their pedagogies and not from access issues (Internet access etc). Finally, experience obtained in e-learning on the FOSS GIS course and on the Nettel@Africa Programme (http://www.nettelafrica.org) where many courses have been delivered online (web-based) would prove useful to e-learning in Surveying, Geo-information Sciences and Land Administration and any other Internet-enabled and delivered courses for that matter.

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ABSTRACT

This paper shares experiences obtained in the Introduction to Geographic Information Systems (GIS) using Free and Open-Source Software. Titled "Free/Libre Open Source Geographic Information Systems - FOSS GIS" the course was provided by the Department of Natural Resources Conservation and the Center for Public Policy and Administration, University of Massachusetts, Amherst, United State of America (USA) under a special grant to Charles Schweik, an Associate Professor in the indicated department and center and the course instructor. The programme ran from February 2007 through May 2007 and was conducted online. Participants/Students came from African countries - Nigeria, Uganda etc, the United States, Brazil and certain other countries.

The experience enable us to assess the impact of Internet access (bandwidth) on the delivery of the online course across and among continents of the world and the effectiveness of delivering graphic based GIS course over the Internet. This paper also share the limitations and problems (selection of Open Source Learning Management System/platform - Moodle, Flash environment and platform compatible web browsers) encountered in the course of delivering the course and how it was resolved, stating areas needing improvement for future online courses delivery in general and GIS in particular (orientation courses etc).

INTRODUCTION

It is important to start with some definitions of electronic learning (e-Learning) as understood and described in many literature and by some researchers and interested people in the field of e-Learning. Nettel@Africa (2003) adopted the definition below for e-Learning as: *"the effective teaching and learning process created by combining digital content with local community and tutor support along with global community engagement"[1]*. Is the above definition all encompassing and universally acceptable or do we have contrasting view in this regard? We look at another definition from managersforum.com http://managersforum.com/eLearning/Index.htm (accessed Monday, April 14, 2008 2.08pm, West African Time), where eLearning was thought to be confusing as it claimed that nobody knows what the "e" is! It claimed however that the "e" surely does not stand for "electronic!!" and that the "e" would be better defined as "**E**volving or **E**verywhere or **E**nhanced or **E**xtended!!!". Simply put, E-Learning to the forum possibly means say Evolving Learning,

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Everywhere Learning or Enhanced or Extended Learning. For the managersforum.com definition therefore, it somehow along the line put it (E-Learning) as follows: *"a learning environment supported* by continuously **evolving** *collaborative processes focused on increasing an organizational performance".* This definition of e-learning sounds interesting except that it is limited again by the use of individual and organizational performance without envisaging the use of e-learning as defined in a governmental or public sector setting or a way of improving non-organized groups performances. It may be taken however that by organization – all forms are intended including private and public organizations. It must be noted somehow that learning may not necessarily be undertaken for improvement purpose. It may be taken for the sake of it, for pleasure or just to obtain qualifications and certifications only whether to be used or not.

Stockley D (2003) on his part defined e-learning as *"The delivery of a learning, training or education program by electronic means. E-learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material.* http://derekstockley.com.au/elearning-definition.html (accessed on Monday, April 14, 2008; 2.37pm West Africa Time). This definition is also very useful since it takes note of mobile learning component of electronic learning. It is however yet to be seen how Internet protocol would be applied in next generation Global System of Mobile Communications (GSM) and Code Division Multiple Access (CDMA) networks such that there will be little or no difference between Internet (as strictly a data communication based network) as compared to voice communications infrastructure, which traditionally telephony network are known for.

E-LEARNING & DISTANCE LEARNING IN PERSPECTIVE
Electronic learning (E-Learning) from my perspective can be described as the use of all form of devices and means, which involves electronic, power and connectivity service of any kind in the process of knowledge acquisition and/or dissemination. Internet and web-based learning, computer-based learning, mobile devices-based learning and all those carried out using digital devices including but not limited to radio, television etc all constitute e-learning tools and enable the scheme as a long-term cost effective means and method of learning and education.

For the purpose of this paper, "E-Learning" refers strictly to the use of Internet-enabled technologies, Internet protocols and web technologies to deliver learning services to various group of students (learners) in many near or remote locations. E-Learning should not been seen from a physical distance perspective that is between instructor(s) and/or learning management platform and learners. It is preferred to avoid the use of such terms as "Distance Learning" because such concept to me makes no real meaning in the Internet age. For instance a student in Africa with appropriate Internet access to a learning management platform location or e-Learning site (say in the United States, Europe or Asia) have the same level of access and are in the same "virtual distance" to the LMP as those of other (learners/students) that are resident in those countries or continent or even within the campus where the e-

learning service is been provided or situated.

The use of classification terms such as "Full-Time" and "Part-Time" statuses for students and learners in courses or programmes has been blurred by the advent of e-learning as a method of educational service delivery. Those classifications I considered as Pre-Internet era classifications. Today, a learner can access e-Class and learning resources (24 hours a day, seven day a week (24/7) and from any location and devices (mobile phone, computer – laptops etc). Similarly, a tutor can attend to his/her student anytime of the day and from anywhere or location. Therefore, the idea of seeing e-Learning from a distance learning or part-time learning perspective or framework does not fulfill the purpose and reality of e-Learning especially as it relates to Internet-enabled one. E-Learning can be supported by "Face-to-Face" components. Again, the availability of multimedia services throws up a new interesting challenge, which is to distinguish between *"Physical Face-to-Face (PF2F)" and "Electronic Face-to-Face (EF2F)"*. It is now possible to see face-to-face using ICTs as against seeing physically i.e. being together physically. Use of videoconferencing infrastructure and services and other multimedia technologies allows practitioners and users of e-learning services and solutions to achieve these objectives.

INTERNATIONAL COOPERATION AND COLLABORATION
The overall objective of this paper is to share the e-learning experience on the Introduction to Free/Libre Open Source Geographic Information System (FOSS GIS) that was offered by the Center for Public Policy and Administration and the Department of Natural Resources Conservation at the University of Massachusetts, Amherst, United State of America (USA). The course was offered from February through May of 2007. The FOSS GIS was publicized both on the centre's website University of Massachusetts, Center for Public Policy and Administration – http://www.umasspolicy.org) and also internationally through the website of the United Nations University International Institute for Software Technology (UNU-IIST), which is based in Macau SAR (Special Administrative Region) of China. It was particularly well publicized through the UNeGov.net website (http://www.unegov.net). UNeGov.net is a website for the UNeGov.net Community of Practice for Electronic Governance and an initiative of the UNU-IIST. The community organizes schools and workshops among others on electronic governance in various countries especially developing countries of Africa, Asia and South America.

As the Country-Organizer for Nigeria, UNeGov.net Community of Practice for Electronic Governance (UNeGov.net COP) I received the announcement for the programme {through the UNeGov.net Administrator – Elsa Estevez, a Research Fellow at the UNU-IIST, Centre for Electronic Governance} and I forwarded the announcement to other members of the communities in Nigeria and Kenya. Similar information was sent to other members of the community in other countries. For the Nigerian environment, I acted as the local coordinator for the course liaising with the course tutor and team at the Centre for Public Policy and Administration at the University of Massachusetts, Amherst. It was a real international collaboration. There was also cooperation among different organizations in terms of initial

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take off of the course in terms of publicity i.e. between the UNU-IIST in Macau and the Centre for Public Policy and Administration at the University of Massachusetts, USA.

E-LEARNING APPLICATION IN GEOGRAPHIC INFORMATION SYSTEM (GIS) TRAINING

There are specific requirements in general to conduct an e-Learning course and/or programme on any subject for that matter. These requirements would be stated here and in addition those other requirements that were used in the FOSS GIS e-Learning course delivery. Standard requirements for an E-Learning (Internet-enabled) course are: Desktop computer or Laptop computer of appropriate specifications both in software and hardware. The software requirements also depend on whether the computer systems run Windows Operating Systems from Microsoft or Linux etc or whether the computer is a Macintosh computer with its software requirements. The initial exercise is to ensure that all participants have the required access device (computer systems) with the right specifications – hardware, software, CD-ROM, USB port etc.

The next step was to ensure that all the user devices/systems can connect to the Internet, doing so using a recommended minimum bandwidth, which is deemed to be appropriate for the course delivery. Participants are also advised on the universal resource locator (URL) for the electronic learning site. It is not sufficient that participants were able to connect to the Internet and also doing so with required bandwidth. It is important to know which web browser was compliant with the learning management system – platform. It must be noted that many web browsers exist today on the Internet/World Wide Web such as Internet Explorer (IE), Mozilla Firefox, and Netscape Communicator etc. It is also important to know which version of these browsers work well with the e-Learning platform of choice. Experience has shown that most e-Learning projects fail without recognition of these facts and basic issues. While on the FOSS GIS course we are able to determine the compliant web browser quickly, the experience to do so was obtained from previous e-Learning experience I had on the Nettel@Africa Programme (http://www.nettelafrica.org; http://kng.nettelafrica.org) a continent-wide (Africa) network for capacity building and knowledge exchange in ICT Policy, Regulation and Application. On that programme, it took us about four months to discover that some browsers used by many students/participants were not compliant with the adopted Learning Management Platform (LMP). In that programme, the LMP was KEWL NEXTGEN and the compliant browser was Mozilla Firefox. We were able to discover this after several failures and unsuccessful attempts to conduct "Multiple Choice Questions – MCQ" online. It was discovered that the Microsoft Internet Explorer usually crash along the line as students attempted to do their test.

On the other hand, for the FOSS GIS course, the LMP was Moodle, and the compliant browser – Microsoft Internet Explorer. So apart from knowing which browser works well with which LMP, it is also important to know which version(s) of the particular web browsers work well with the e-Learning system and platform. This is a first and fundamental requirement when setting up and adopting e-learning as a mode of knowledge delivery. And

this information must be communicated in early enough to learners in any e-learning programme or on any course conducted online. In fact, this is one of the most critical activities in any online orientation programme for virtual students/learners and instructors.

FREE/LIBREE OPEN SOURCE SOFTWARE GEOGRAPHIC INFORMATION SYSTEM (FOSS GIS) TRAINING USING E-LEARNING APPROACH

The FOSS GIS course ran for a period of twelve (12) weeks based on how it was structured, which is sequential in approach. The course was delivered using a publicized course timetable and calendar. The FOSS GIS course generally contained the following elements:

- People: participants includes a lead instructor, other support tutor(s) about four or five of them and online students (who are virtual learners in this case) from various countries, Nigeria being one of such nations.
- Course schedule: the entire course was scheduled into five (5) parts. Part one deals with introduction to the course and the setup environment for proper take-of of the course; part two deals with GIS Input methods; part three concerns GIS databases, part four (Analysis) - making map in QGIS, analysis using the QGIS GRASS Plug-in and site selection using raster and vector analysis. Part five contains the concluding materials FOSS as a collaborative paradigm and contribution to FOSS Project, which was introductory and informational and research and development is continuing in this area
- Lecture slides and home work assignments and submissions

The introduction part, which deals with setup environment of the FOSS GIS E-Learning site, is particularly critically to the success of the online course without which nothing else can be done further. This part commenced with an orientation activity where the course lead instructor got everyone (learners, tutors etc) together through the chat system on the e-learning (Moodle) platform and general introduction were made (before this, we made attempt to use yahoo group and google group and email systems for communication purpose, but these platforms were not totally reliable). In the Nettel@Africa experience, the e-learning platform has in-built, internal email address system similar to Microsoft Outook and other client email service). The orientation period enabled the class to ensure that all participants were connected and fully ready for the course. It also allowed the class to know that all hardware and software requirements as needed for the course were met and this includes: trying out the class communication systems, which was used as the first exercise for the class, installing flash player for the course lectures on participants systems (another class exercise), course introduction lecture – testing of the web browser for compliance with the e-learning environment and confirmation of same through display of expected "screencast".

The above exercises were followed by installation of portable document file creator (PDF creator) and installation of the open source software Quantum GIS (QGIS) on participants various systems. Introduction to GIS, QGIS overview, map, space, spatial representation and evolution of geographic analysis were delivered online using the setup environment. The GIS input methods covered in the course of the online courses included georeferencing concepts,

GIS building process and web GIS resources (US and global), which was done as exercise. Massachusetts, USA digital data and georeferencing with QGIS, on-screen digitizing of features using a scanned map and use of global positioning systems (GPS) were covered and done in exercise mode. This is a very interesting part of the course especially as it concerns knowledge exchange and information sharing as a form of international collaboration and cooperation. Such data would ordinarily not be available to developing countries and their students. Insight in this regard also helped to prepare minds of participants from developing worlds on the important of GIS data and spatial information and their application in development such as in planning cities, land administration and environmental management including pollution prevention control, erosion control & management and forest management etc.

Mapping GPS points with QGIS and adding attribute data and introduction to relational databases among other forms of databases applicable to GIS were covered. The course was further deepened and extended through the delivery of spatial data engines (postgreSQL, and postGIS) and integration of spatial and non-spatial data. While this paper presents a reasonable coverage of the course as delivered, specific details and in-depth knowledge of the course can be obtained by contacting the course instructor Prof. Charlie Schweik who can be reached at: cschweik@pubpol.umass.edu . We are now in the process of moving these materials permanently to OSGeo's education group (http://www.osgeo.org). It must be stated that the entire success of the online course was made possible due to the planning and design methods used by the lead instructor, which involved the use of about four or five co-instructors that handled various aspects (parts) of the course thereby making it lively, and the experience great. Participants also benefited from expertise and contributions of these co-instructors and faculties used in delivering the course.

LIMITATIONS AND PROBLEMS ENCOUNTERED WITH E-LEARNING (INTERNET-ENABLED) COURSES AND PROGRAMS GENERALLY

There are often limitations or problems with e-Learning. Attwell (2008) claimed that in any list of problems of e-learning (of course there are several of them) two issues stand out. One accordingly to him is that the learning materials are unattractive and non-compelling; the second is the poverty of pedagogies for e-learning. While the second point that concerns e-learning pedagogies is of great interest to me because of its high importance in any e-learning deployment and applications, below are highlighted some important limitations and problems encountered with web-based, Internet-enabled e-learning courses in generally and based on my personal experience and feedback from fellow students and classmates in different e-learning class:

- Inadequate Internet bandwidth from learner's system to the E-Learning Platform and server(s)
- Lack of Knowledge of compliant web browser(s) and other systems software requirements
- Lack of skillful online tutor(s) and moderators capable of maintaining efficiently and effectively online communities of learners and students

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- Time discipline with respect to follow through course calendar
- Insufficient and inappropriate pedagogies of e-learning

While the stated points are generally problems related to use of E-Learning in general, problem 1 above was re-observed during the FOSS GIS online course while it was a main issue with the Nettel@Africa Programme. We observed however that for workers with high-speed Internet connection in their offices, there were little or no problem with their being able to access the E-Learning platform except where network level security restrictions were in place on such learner's employer(s) company network for access to external sites that have not been explicitly authorized based on their internal ICT Internet access Policies and Regulations. It therefore follows that where students and/or learners are of working class type, Internet Access issues may be minimized except for the points indicated above. We also observed that most workers who are learners are also able to possess computers at home including a laptop, which they are able to use to access the Internet using mobile wireless technologies (in Nigeria such as CDMA and now GPRS/3G and Fixed wireless Access - FWA). The above stated technologies among others such as ADSL and other broadband access are available readily in developed countries and therefore not an issue here. The issues of Internet access bandwidth are therefore mostly limited to unemployed learners and participants who either not afford a separate individually owned laptop or computer or pay for required Internet access at the appropriate bandwidth required for the course. This is because the requirement is more than that of checking an email or visiting a social network sites or engaging in online chat. Internet service for the purpose of e-learning is general and GIS in particular must be reliable and of relative good quality for the experience to be worthwhile otherwise it will result in frustration on the part of learner(s) and could lead to disengagement from the course. A good e-learning solution should therefore ensure that specific centres are available for universal access to ICTs (which is the Internet in this case). Such ICT e-learning centres must be particularly planned and designed to be capable to handle e-learning training operations reliably and with utmost stability. Pricing can then be done using the "Pay-As-You-Go" model so that they are affordable to participants that are not of the working class type and still require training via online means.

For the remaining three factors highlighted above, the FOSS GIS course recorded excellent in them because we had not only committed instructors for the course but also backed-up by other tutors that continuously provide support to the community of learners day-in, day-out and ensure planned progression on the course based on the publicized course calendar. This was a very good development. We were also able to achieve synchronous communication through available Chat System within the LMP and also discussion forum(s). The last three factors were issues in the case of Nettel@Africa programme because while we recorded excellent in some courses there were other courses where the tutor(s) and moderator(s) were not very committed. It is therefore very important that these points be noted in the deployment of E-Learning approach in any course of study including in Surveying, Geo-informatics and Land Administration.

SUCCESS FACTORS – ADOPTING INTERNET-ENABLED E-LEARNING

It is also important to highlights some factors that enable e-learning to be deployed, adopted and accepted by learners, tutors, students, support staffs, administrators and implementers of e-education programmes generally whether in the enterprise (a single department of it or the organization as a whole) or in an institution or school. Schooley (2002) listed three general factors that contribute to successful e-learning programmes as technology, content and culture. White (2006) was able to analyze critical success factors for e-learning and institutional change from some organizational perspectives on campus-wide e-learning. While the research use evidence drawn from a series of surveys of staff attitudes to the use of computers in teaching with the first perspective using a single UK institution, the second perspective investigated six different UK universities. Higher education practice manifested through their organization, structure, culture and climate were considered factors that impact upon the potential for higher education to embrace and manage change in its educational activities; especially technology enhanced learning such as blended learning and e-learning White (2007). An interesting point in White's review and research is the concept of research-intensive and teaching-intensive universities in the UK, with differences in the financial status of such institutions, which is thought to affect their adoption of e-learning and/or technology enhanced learning among other. While there are different many ways to look at success factors for adoption and use of e-learning in particular, I considered the points below as very critical in any deployment irrespective of the culture, climate, technology and content of the e-learning scheme. This is also based on my experience in three different e-learning (web-based) courses and programmes (FOSS GIS, Nettel@Africa and ICT4D Collectives forum) involving many nationalities. These are:

- Proper Orientation for virtual learners and participating tutor(s) at the beginning of course or programme under consideration
- Discipline in the use of time table and course calendar(s) as planned and publicized at the beginning of the course or programme
- Availability of skills (manpower) and possession of keen interest by the course designers, instructors and moderators at maintaining online communities of virtual learners and students
- Availability of resources to lead and moderate chat system, discussion forums and respond in good time to emails (enquiries, assignments and exercises etc), which makes the experience worthwhile for virtual learners and to keep them engaged throughout the duration of the course and possibly afterward.
- The E-Learning system approach should have room for offline support services such as the use of CD-ROMs, USB (Flask drive/disk) and other storage media. That way, learners are able to possess contents similar to those available on the Internet and course website for offline use. This is good especially in an environment where Internet access is a clear issue and bottleneck to course delivery
- Where possible, all the above should be backed up with once-in-a-while "Face-to-Face, F2F" meetings, which could be delivered regionally (for worldwide programme) or group wise (for online courses taking place in the same or close-by campuses)
- The "Face-to-Face" meeting could also be in form of workshops, conferences and/or

seminars such as this FIG forum so that learners and tutor(s) can meet once in a while and put faces to the virtual environment. This is helpful during this transition period as most learners for now are used to the "Classroom Type" method of schooling and learning.
- Use of Skype software/technology, which we recently found to be useful as communication tools to E-Learning in practice. The technology incorporates chat system and IP Telephony capabilities (or Voice over IP – VOIP). Recently, Facebook (www.facebook), a social utility tool also provide away to form group and could be utilized in any e-learning deployment. This has been tried in our ICT4D collectives' postgraduate moodle environment at the UNESCO Centre for ICT4D, Royal Holloway University of London (RHUL).

For the FOSS GIS course, most of the points highlighted above were utilized except for the face-to-face model, which was not specifically incorporated in the design of the course. However, we evolve a "Quasi-Face-to-Face" approach in the Nigerian environment during the learning period since I acted as the local coordinator and responsible for taking delivery of the CD-ROMs from the Centre for Public Policy and Administration at the University of Massachusetts and distribute same to learners in Nigeria, which I sometime do physically. Some of us in the Nigerian environment also meet locally in group of two or threes to specifically help out one another where online/virtual support has not been particularly successful. The idea of adopting the Quasi-F2F approach in the FOSS GIS course was based on my experience on the Nettel@Africa programme where those of us who had the University of Lagos, Akoka, Lagos campus as our home institution usually meet once-in-a-while at the campus for F2F discussion and exchange of questions and solutions to problems highlighted by different learners in the programme, which usually come from diverse backgrounds. For such F2F meeting, our programme coordinator is usually in attendance thereby bringing authority to it.

The Nigerian participants on the bases of the above in the two E-Learning programmes (FOSS GIS and Nettel@Africa) have been quite successful. In particular, for the Nettel@Africa Programme, my home institution, the University of Lagos has been particularly successful among the four universities selected by Nigerian Communications Commission (NCC) for participation in the continent-wide Nettel@Africa programme, which basically use E-Learning as the main mode of programme delivery and uses open source software – KEWL NEXTGEN (http://kng.nettelafrica.org). Students and learners from some of the other universities have accordingly had to transfer or request for transfer to the University of Lagos environment. It will be worthwhile for the Federation of International Surveyors and ITC to take note of these points in the design, planning and implementation of any of their intended E-Learning courses and programmes including in Surveying, Geo-informatics and Land Administration especially where participants are desired from the developing nations.

CONCLUSION
A highlight of the discussion so far on sharing our experience on the FOSS GIS online course

with extracted support (experience) from the Nettel@Africa programme on network for capacity building and knowledge exchange in ICT Policy & Regulations include E-Learning setup environment and operation which are dealt with: determining compliant web browser with the learning management system & platforms, determining compliant version(s) of the said compliant browser(s), determining appropriate bandwidth that meet the requirements of the course being delivered/or under consideration, determining the multimedia environment (Flash etc) especially for graphic based courses such as Geographic Information System (GIS), determining and consideration for the time zones of different participants across continents (objectives of which are to benchmark appropriate time that all participants can connect to the e-learning environment for synchronous learning and use of chat system/tool within the learning system). It was also highlighted the need for skills and interest on the part of course instructors, moderators and course designers to back up the virtual environment training with face-to-face support either on regional bases or on group based within a campus or across a country or continent. We stated that lack of available and/or adequate Internet bandwidth or access should not be used or given as excuse or reason for failure or slow take-of of E-Learning for courses delivery. It was also established that CD-ROM and other physical media support can be used in the short-to-medium term to support the E-Learning environment as we transit from the "Physical class room" based learning environment to virtual or e-Learning environment. The paper contained a highlight and relative discussions on factors that affects success of E-Learning delivery in general, problems and limitation encountered for the FOSS GIS and Nettel@Africa programmes and approaches adopted to resolve them among many others.

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BIBLIOGRAPHICAL NOTES

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Toyin Oloniteru is a director at Knowledge Age Africa Limited, GSL E-Solutions Global Limited and head the IT & Telecommunications Group at ATM Consortium Limited, Nigeria's premier ATM Deployer and electronic payment company (being start-up member of the strategic management team), setup the company functionally having worked in collaboration with Accenture Nigeria and Euronet Worldwide, European Operation Centre in Budapest (Hungary). He successfully tested and make operational CDMA connectivity for ATMs in Nigeria

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reliably and now in proof of concept phase for GPRS/3G service for e-Payment terminal transactions acquiring connectivity. He has lead the system design and project management on use of vagaries of telecommunications service for ATM connectivity including but not limited to VSAT (Ku-band, C-Band), ISDN/ADSL, and Fixed Wireless Access (FWA) etc. Mr. Oloniteru also previously worked at Resourcery Limited, Lagos as an Internetwork Specialist (Converged Network – Data and Voice Communication).

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