> **Keynote Address by Professor Chris Bolu, Director ICT, Federal University Oye-Ekiti at the Opening of the Software Freedom Day 2013 held at Federal University Oye-Ekiti, on September 21, 2013**

1.0 Introduction

Free and open-source software (FOSS) is software that can be classified as both free software and open source software. That is, anyone is freely licensed to use, copy, study, and change the software in any way, and the source code is openly shared so that people are encouraged to voluntarily improve the design of the software. This is in contrast to proprietary software, where the software is under restrictive copyright and the source code is hidden from the users, so that the rights holders can sell binary executables. Free, open-source operating systems such as Linux and OpenBSD are widely utilized today, powering millions of servers, desktops, smartphones (e.g. Google Android), and other devices. Free software licenses and open-source licenses are used by many software packages

2.0 FOSS Adoption

FOSS (Free/Open Source Software) has grown in leaps and bounds during the last two decades, and has been seeing widespread adoption in domains like E-governance, SME s, Education and Research, etc . While almost all organisations use FOSS in some form today, there is a wide variation in the manner and extent to which they do so, and presently no quantitative measure exists that can capture the true picture. Also, while most organisations that use I.T. today are certain to be using FOSS in some way or the other, the manner and extent to which FOSS gets used would vary greatly across organisations. "Squirrel Mail" may be the only FOSS product used by one organisation, where as another organisation might have migrated its entire IT infrastructure as well as applications to FOSS.

Although today there is no way of objectively assessing and stating this difference in the 'FOSS Maturity' or 'FOSS Friendliness' of organisations in a quantified manner, work is on to fill this gap by defining a single number, such as the FOSS Adoption Index (FAI), to convey the standing of an organisation in this regard. Such measures do exist today for many FOSS products and technologies that convey in a quantified manner their performance, reliability and robustness, extent of documentation and support available etc. to enable a prospective user to assess their suitability for

his/her use. Some of the popular examples of how the maturity of open source products is assessed in a quantitative manner in order to help organisations choose a product for their adoption are:

- Business Readiness Rating
- Open Source Maturity Model
- Open Source Potential Index, which has been used to rank countries on two indices (Activity and Potential) based on their usage, adoption and support of FOSS.
- FOSS Maturity Level

Looking at FOSS tools, common attitudes and concerns, and challenges with regard to FOSS adoption. We find that drivers for adoption and risks associated with FOSS were the most prevalent. More specifically, the misperceptions of FOSS, the new security challenges presented by the smart grid, and the extensive influence of vendors in this space play the largest roles in FOSS adoption.

3.0 Countries adopting FOSS

Several Governments all over the world have expressed support or made significant adoption of FOSS. Examples are:

- The Government of Kerala, India, announced its official support for free/open-source software in its State IT Policy of 2001, which was formulated after the first-ever free software conference in India, "Freedom First!", held in July 2001 in Trivandrum, the capital of Kerala, where Richard Stallman inaugurated the Free Software Foundation of India. I have been to Trivandrum, where we had a Company with significant software factory in one of the TECH Camps.

- The German City of Munich announced its intention to switch from Microsoft Windows-based operating systems to an open-source implementation of SuSE Linux in March 2003, having achieved an adoption rate of 20% by 2010.

- In 2004, a law in Venezuela (Decree 3390) went into effect, mandating a two-year transition to open source in all public agencies. As of June 2009 this ambitious transition is still under way.

- In 2005 the Government of Peru voted to adopt open source across all its bodies. The 2002 response to Microsoft's critique is available online. In the

preamble to the bill, the Peruvian government stressed that the choice was made to ensure that key pillars of democracy were safeguarded: "The basic principles which inspire the Bill are linked to the basic guarantees of a state of law."

- In 2006, the Brazilian government has simultaneously encouraged the distribution of cheap computers running Linux throughout its poorer communities by subsidizing their purchase with tax breaks.

- In April, Ecuador passed a similar law, Decree 1014, designed to migrate the public sector to Libre Software.

- In July 2001 the White House started moving their computers to a Linux platform based on Red Hat Linux and Apache HTTP Server.[2] The installation was completed in February 2009. In October 2009 the White House servers adopted Drupal, an open source content management system software distribution.

- In January 2010, the Government of Jordan announced that it has formed a partnership with Ingres Corporation, a leading open source database management company based in the United States.

- As local governments come under pressure from institutions such as the World Trade Organization and the International Intellectual Property Alliance, some have turned to Linux and other Free Software as an affordable, legal alternative to both pirated software and expensive proprietary computer products from Microsoft, Apple and other commercial companies. The spread of Linux affords some leverage for these countries when companies from the developed world bid for government contracts (since a low-cost option exists), while furnishing an alternative path to development for countries like India and Pakistan that have many citizens skilled in computer applications but cannot afford technological investment at "First World" prices.

- State owned Industrial and Commercial Bank of China (ICBC) is installing Linux in all of its 20,000 retail branches as the basis for its web server and a new terminal platform. (2005)

- Cuba - Students from the Cuban University of Information Science launched its own distribution of Linux called Nova to promote the replace of Microsoft

Windows on civilian and government computers, a project that is now supported by the Cuban Government. By early 2011 the Universidad de Ciencias Informáticas announced that they would migrate more than 8000 PCs to this new operating system.

- In 2010 The Philippines fielded an Ubuntu-powered national voting system.

- In late 2010 Vladimir Putin signed a plan to move the Russian Federation government towards free software including Linux in the second quarter of 2012.

- Iceland has announced in March 2012 that it wishes to migrate to open source software in public institutions. Schools have already migrated from Windows to Ubuntu Linux.

4.0 Adoption in Education

Linux is often used in technical disciplines at universities and research centres. This is due to several factors, including that Linux is available free of charge and includes a large body of free/open source software. To some extent, technical competence of computer science and software engineering academics is also a contributor, as is stability, maintainability, and upgradability. Examples of large scale adoption of Linux in education include the following:

- The OLPC XO-1 (previously called the MIT $100 laptop and The Children's Machine), is an inexpensive laptop running Linux, which will be distributed to millions of children as part of the One Laptop Per Child project, especially in developing countries.

- Republic of Macedonia deployed 5,000 Linux desktops running Ubuntu across all 468 public schools and 182 computer labs (December 2005). Later in 2007, another 180,000 Ubuntu thin client computers were deployed.[48][49]

- Schools in Bolzano, Italy, with a student population of 16,000, switched to a custom distribution of Linux, (FUSS Soledad GNU/Linux), in September 2005.

- Brazil has 35 million students in over 50,000 schools using 523,400 computer stations all running Linux.

- Government officials of Kerala, India announced they will use only free software, running on the Linux platform, for computer education, starting with the 2,650 government and government-aided high schools.

- The Philippines has deployed 13,000 desktops running on Fedora, the first 10,000 were delivered in December 2007 by Advanced Solutions Inc. Another 10,000 desktops of Edubuntu and Kubuntu are planned.

- Russia announced in October 2007 that all its school computers will run on Linux. This is to avoid cost of licensing currently unlicensed software.

- The Chinese government is buying 1.5 million Linux Loongson PCs as part of its plans to support its domestic industry. In addition the province of Jiangsu will install as many as 150,000 Linux PCs, using Loongson processors, in rural schools starting in 2009.

- In 2012 the Leibniz-Rechenzentrum (Leibniz Supercomputing Centre) (LRZ) of the Bavarian Academy of Sciences and Humanities unveiled the SuperMUC, the world's fourth most powerful supercomputer. The computer is x86-based and features 155,000 processor cores with a maximum speed of 3 petaflops of processing power and 324 terabytes of RAM. Its operating system is SUSE Linux Enterprise Server.

- In 2009 Venezuela's Ministry of Education began a project called Canaima-educativo, to provide all students in public schools with "Canaimita" laptop computers with the Canaima Debian-based Linux distribution pre-installed, as well as with open source educational content.

5.0 Benefits

There are benefits and advantages of Free and open-source software. Some are:

- Can be adapted to the underlying hardware solution

- Can be customized to meet job specification as exactly as possible

- Can be security audited

- Can by the user, being an individual, a company or a public institution, or by some contractor(s) without the slightest vendor lock-in

- Usually there is an abundance of more or less experienced contractors available to accomplish the tasks above and also the system administration

- The profile of the potential contractor starts at some student (or pupil), a freelancer, some Small and medium enterprises to huge corporations

- Stability and security issues can be addressed and resolved in a direct manner by the user or all users using a community approach

- Higher motivation to exchange testing results and user experiences between adopters directly or openly, especially if they are not competitors

- Higher motivation to contribute back to the software by bug-reports, since there is no external profiteer, that could charge for the improvements and bug-fixes, because the code is simply available

- At will cooperation based on mutuality and reciprocity

- There is no contractual dependency on the vendor whatsoever; (please note that a lack of resources to work with the source code is not solvable by any license)

- Very often free and open-source software if also free of cost, leaving maximum financial leverage to be put into the tailoring of the entire hard- and software solution (which can be outsourced to external contractors)

- Very ubiquitous free and open-source software, depending on the adoption rate and the time scale, has been extensively security audited and tested on many hardware solutions and in various application scenarios; e.g. the Linux kernel is ubiquitously in use on servers, routers and mobile devices all over the world, hence field-tested and case-hardened for the exposure in the Internet.

- Software is an immaterial good; when such a good is distributed under a free and open-source license, its monetary and non-monetary value to its users and to the economy they are part of can multiplies heavily.

6.0 FOSS at Federal University Oye-Ekiti

In Federal University Oye-Ekiti, FOSS is part and parcel of the University ICT policy approved by the Senate on September 19, 2012. In the chapter on APPLICATIONS OF ICT TO EDUCATION IN FEDERAL UNIVERSITY OYE-EKITI, it elaborates the use of FOSS in the following areas of Education delivery:

- E-books/e-journals
- E-Assessment/E-Testing
- E-learning
- Teleconferencing
    - Audio-conferencing
    - Audio-graphic conferencing
    - Video-conferencing; and
    - Web-based conferencing.
- E-collaboration
- Integrated E-Business Process

In the Faculty of Engineering emphasis is placed on the use of FOSS in Computer Aided Engineering such as in courses in Computer Aided Design (CAD), Computer Aided Analysis (CAA), Computer-integrated manufacturing (CIM), Computer Aided Manufacturing (CAM), Materials Requirement Planning (MRP), Computer Aided Planning (CAP)

Examples of FOSS software used in Computer Aided Engineering courses are:

- Salome-Meca - 3D CAD, Meshing. Post Processing, Multiphysics Finite Element analysis
- Code Aster - multiphysics Finite Element analysis
- OpenFOAM - multipurpose CFD oriented solvers
- Elmer - multiphysics FE package
- Calculix - pre-post & FE solver, Abaqus-like syntax
- Code-Saturne - 3D CFD solver
- GMSH - Scriptable & general purpose geometry modelling, meshing and post processing
- MBDyn - multibody dynamics. comes with a Blender interface, animation of results with easyanim
- Scilab - Matlab/Simulink-like mathematical programming environment
- wxMaxima - Maple like symbolic computing environment
- R and RKWard - Mathematical modelling & statistics (similar to S-Plus)
- QCAD - 2D & 3D CAD programs

The Policy identifies and defines the expected ICT Literacy Levels as shown in the Table below:

3-Tier ICT Literacy

Definition

L	Content	Certification	For Whom
1	Linux Level 1	LPIC-1, LIBRE Office	All Students
	Microsoft Office Specialist	MOS: Microsoft Office Word, Excel, PowerPoint,	All Students
2	Linux Level 2	LPIC-2	Science, Engr
	Microsoft Office Specialist Expert	MOS: Microsoft Office Word, Excel MOS: Microsoft Office PowerPoint	Science Engineering
	Autodesk, Oracle, SAP, CISCO	AutoCAD, SAP TERP10, OCP, Java, CCNA, CCNA Wireless, CWNA	Engr, Sc, Agric
3	Linux Level 3	LPIC-3	Engineering
	Microsoft Office Specialist Master	MOS: Microsoft Office Word, Excel, PowerPoint	Engineering Science
	Autodesk, Oracle, SAP, ESRI, Mathworks	Inventor, Map, OCP, Java, GIS, MATLAB, Scillab	Science, Agric Engineering

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7.0 Conclusion

a. Challenge: Although globally, FOSS (Free/Open Source Software) has grown in leaps and bounds during the last two decades, and has been seeing widespread adoption in domains like E-governance, SME s, Education and Research, where is Nigeria in this comprehensive adoption of FOSS in Governance, Education and Public utilities?

b. There is the need for Higher Education Institutions in Nigeria to increase their FOSS adoption through their academic programmes.

c. More efforts to be made by organisation such as this to sensitise the populace on the Features, Benefits and Advantages of FOSS.

d. Increased research should be done by this organisation on the FOSS usage and adoption in different classes of organisations.

8.0 References

1. Federal University Oye-Ekiti, ICT Policy, September 19, 2012, Nigeria

2. Several Internet Wikipedia references accessed September 19, 2013.