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**FREE AND OPEN SOURCE SOFTWARE: A KEY ENABLER FOR DIGITAL INDIA****Ranjan Kumar**

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**Abstract**

Free and Open Source Software (FOSS) by its intrinsic nature of sharing, both in development and distribution, can play an important role in promoting e-Governance and put in place a robust digital economy. Numerous surveys conducted in the last two decades throughout the world clearly points out to the maturity of FOSS ecosystem. It has effectively converted digital paradigm into an empowering tool. It is particularly significant where economy of scale, mass adoption, reliability and large-scale customization are the key attributes in providing solutions in the area of Governance, social welfare and economic administration. These are precisely the key features which needs to be addressed for developing nations like India, which has adopted digitalization as an effective tool for Governance and welfare. Use of FOSS in India is quite rampant in education and in providing business solutions and services. FOSS has been effectively harnessed in several projects to upscale the existing services successfully. However, most of these efforts have been at the level of the individual and sporadically at the level of the state. The IT policy of the Government of India, notified in 2015 in its policy statement, makes adoption of FOSS mandatory for their departments and undertakings. This can prove to be a game-changer in the creation of digital India, in the most transparent, equitable and cost-effective transition. Several large projects of Government of India have already leveraged FOSS in execution and delivery of e-Governance services to the masses.

**Keywords:** FOSS, e-Governance, Digital India.**Introduction**

Free and Open Source Software (FOSS) has assumed a great significance in recent times, primarily due to its role in the furtherance of Digital citizenship as a whole and digital economy in particular. This is because FOSS follows a shared model of software development and distribution based on the twin praxis of free exchange of information and open collaboration. By definition FOSS comprises of codes or programs whose licenses embodies the users the freedom to run the program for any purpose, to study and modify the code, and to redistribute copies of either the original or modified program without having any obligation to pay

royalties to previous developers. Central to the development of FOSS is the availability of the source code with the distribution of software. The genesis of the contemporary FOSS movement is traced to Richard M. Stallman of Massachusetts Institute of Technology (MIT, USA), who began the GNU (GNU is a recursive acronym for "**GNU's Not Unix!**") project in 1984 to launch a UNIX like robust and powerful operating system, but differing from Unix by being free software and containing no Unix code. This was followed by the setting up of the Free Software Foundation [1]. The other significant milestone in the journey of the FOSS movement is the writing and its wide distribution of a Unix-like kernel by Linus

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Trovalds, a second year graduate student at the University of Helsinki in 1991. By 1993 both GNU/Linux and 386BSD were found to be reasonably stable platforms. The FOSS has witnessed phenomenal growth and expansion since the late 1990s primarily aided by the massive rise and spread of Internet and World Wide Web technologies across the world. FOSS is the bedrock of the most substantial digital innovations in the past 25 years – chiefly on the Internet. Tim Berner-Lee's original World Wide Web was implemented using FOSS. HTML –the language which supports millions of web pages is FOSS too. FOSS implementation has built Google, Amazon, Twitter, Wikipedia, Facebook and Mozilla platforms such as Firefox and Thunderbird. FOSS is fundamental to content management system (CMS) like Joomla and Drupal, server and operating systems e.g. Linux, GNU, Apache etc., My SQL, PostgreSQL as database besides providing a variety of customised software like Audacity, Gimp, Blender and LibreOffice.

### Adoption of FOSS

While the characteristic features and the philosophy of FOSS movement and products are well documented (See for example [2, 3] and references therein) the issue of adoption of FOSS in various domains has attracted considerable attention in the recent times. There has been widespread adoption of FOSS in domains like education and research, E-governance, Small and Medium Enterprises (SMEs) etc. A survey done a decade ago has shown adoption of FOSS to the extent of 78% by the public administrations of 13 European countries [4], while at the same time 87% of the institutions surveyed in the US at the same time have reported the use of FOSS [5]. However, these surveys which show encouraging trends for FOSS adoption are mainly concerning the public institutions. The usage of FOSS in private enterprise, industry and personal space though limited a few years

ago is fast catching up. A Gartner study has shown that by 2016 most software makers will utilize some open source applications or code in their portfolio. This study also reaches the conclusion that 99% of Forbes' Global 2000 companies will be using some form of open source software. The open source Linux market has seen a growth of about 18% year-on-year as compared to there being only 4-5% growth in Windows [6]. The list of world's top 500 fastest supercomputers released by Top500 very recently in November 2016 shows almost every supercomputer (498 of 500) running on Linux [7], while in 2005 only 60% of the top 500 fastest computers were running Linux. Many large and mid-size enterprises are making a transition to open source. This is revealed by Black Duck Software's Future of Open Source Survey 2014. Over 50% of the respondents in the survey said that they were planning to use open source for managing their internal operations. The Black Duck Software survey has revealed that FOSS adoption by companies in 2016 has increased to 65% whereas in 2015 it was at 60% [8]. In this context Gartner says [9], "By 2018, more than 70% of new in-house applications will be developed on an open source DBMS, and 50% of existing relational DBMS instances will have been converted or will be in process." To the extent that quality, reliability and ease of customization are evidently better with FOSS products, they are invaluable and attractive to developing nations like India which wishes to leap-frog into a more transparent, democratic and a governance which is meritocratic.

### E-Governance and use of FOSS

The perceived advantage of FOSS in the public sector includes its capacity to support e-literacy across education, governance and business enterprise. It reduces dependency on foreign vendors of proprietary software (for example Microsoft). The usage of FOSS platforms enhance agile adaption and innovation which includes embedded software

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in consumer devices. It greatly facilitates IT access for local and remote communities, thus facilitating local and multilingual platforms. In short, it builds and support regional and global cooperation [10]. The US administration now strongly advocates FOSS usage since 2003, while the current UK government has made FOSS central to its Big Society Agenda (Digital Service Manual, 2013). The European Commission's activities in the FOSS domain have also lead to the delivery of FOSS tools in support of e-Governance processes since 2007. The largest number of FOSS developers, 16.5%, are from France where as Germany with 12.5% has the second largest developers/contributors to FOSS in the world. Government of India also shown a strong interest towards the use of FOSS in last couple of years. GOI has formulated and approved three polices on "Adoption of FOSS" [11], "Policy on collaborative application development" [12] and "policy on open application program interface (API)" [13] support and encourage the collaborative development and reuse/integration of govt. applications with lesser cost, quality and transparency.

**Adoption of FOSS in India**

In the Indian context e-transactions related to e-governance projects have doubled in 2015 and they have increased by 60% in 2016. 6.95 billion transactions took place in 2015 where as it was 10.89 billion in 2016 [14]. Total of 3000 eservices provided to citizens by the centre as well as state Governments and many of them e-services running FOSS. Most significantly in terms of diversity of use and sheer scale the union and state governments in India, have been early adopters of both the concepts and practices of FOSS. In 2001, the Government of Kerala declared official support for FOSS in its State IT policy, while the Tamil Nadu government issued a circular in November, 2011 to mandatorily install BOSS, an OSS operating system in all its offices. The National Resource Centre for Free and Open

Source Software (NRCFOSS) is an initiative of the Department of Information Technology, Ministry of Communications & Information Technology, Government of India. NRCFOSS was setup in Chennai in April 2005 with the primary mandate to bridge the digital divide as well as strengthening the Indian Software industry. The MHRD, GOI issued an advisory on 17.6.2014 to all educational bodies to use OSS in ICT contents to make ICT education cost effective and ethical. By ethical it gave clear direction to use and propagate FOSS products.

**FOSS in large government application**

The Indian Government has leveraged FOSS in some successful large applications for public use. Some of which are enumerated below.

- **Digilocker:** DigiLocker is a Government of India project which Indian citizens a free platform to store and access important documents and testimonials. The platform uses several open source tools to deliver a mass secure solution and thus contributes back to the ever-growing community [15]. This aids to transparency in Governance and cuts red-tape.
- **Aadhar Project:** The Aadhar project is a huge consumer of FOSS tools. The general interest in the project, its wide applicability in nation building has invited contributions and support from volunteers, user communities and technology teams. About 1.1 billion Aadhar card has been generated till date and is the large repository of Biometric data in the world. [16] Aadhar and e-Aadhar have a potential to take the concept of digitalization to the masses, whereas it is aiding a transparent Governance
- **Centre for Railway Information Systems (CRIS):** CRIS has utilized Red Hat® Enterprise Linux® as its back-bone for mission-critical systems, thereby hugely increasing the scalability for online ticket bookings for the carrier Indian Railways. It is now able to cater

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to nearly 2 million passengers a day involving over 2,500 trains. It is fairly a robust and reliable system that is equipped to handle about 25,000 concurrent users during peak booking periods. It deploys a highly scalable solution based on open standards. It needs to be mentioned here that before migrating to open standards by joining hands with Red Hat it could hardly handle a mere 10,000 concurrent users. Now, this online ticketing system, after enhancements to CRIS' application, has reduced transaction response times and has succeeded in booking a record high of more than 65,000 tickets during peak hours. [17]

➤ **BSE, Mumbai:** For the last two decades, BSE had been struggling to meet business needs while using proprietary technologies. The exchange did not indulge in any innovation. Moreover the exorbitant cost of upgrades rendered its system economically inferior. The Indian stock exchange built a new trading system using open source technology from

Red Hat. As a result, BSE has expanded from 10 million to 400 million orders per day, achieved the fastest trading speed in the world, and reduced its total cost of ownership (TCO) by 90%. [18]

**Conclusions**

Open Source tools and Open Standards have matured in the last two decades and is being increasingly used throughout the world to provide solutions where speed and mass consumption are required. It is thus proving to be an effective tool for e-Governance and digitalization of Governance, business enterprise and providing services. The inherent strength of FOSS tools makes its usage an invaluable tool for developing nations like India. India is well placed to harness the full potential of the FOSS ecosystem, as several successful projects of the Government has shown. It is heartening to note that the requisite policies are formulated by the Indian state to leverage the full potential of FOSS tools in the journey of Indian economy to a digital and robust economy.

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