DG DIGIT

Unit.D2 (Interoperability Unit)

Open Source Software Country Intelligence Report

India

2021

ISA²

This research was carried out for the ISA2 Programme by Wavestone's European Services team. This report was enriched with the kind contribution of Satish Babu, Founder-Director of the International Centre for Free and Open Source Software - ICFOSS (India).

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Updated in May 2021

Table of Contents

INDIA **3**

EXECUTIVE SUMMARY 3

ACTORS 3

POLICY AND LEGAL FRAMEWORK 5

OPEN SOURCE SOFTWARE INITIATIVES 6

India

Executive Summary

The Ministry of Electronics and Information Technology (MeitY) is the main federal entity in charge of ICT policies and India's digital transformation, including the integration and development of open source software (OSS) policies and initiatives in the country. The Ministry is assisted by other entities such as the Digital India Corporation (DIC) and its National e-Governance Division (NeGD) as well as by the IT in Emerging Areas Division (ITEA) of the MeitY which is specialised in the research and development of emerging technologies. The development of OSS is also supported by a vast network of research centres across the country.

Under the impetus of the development of OSS in the State of Kerala, in 2015 India adopted a set of policies promoting the use of open source in the conception of every software developed by the federal government and its organisations. The implementation of this set of policies, which is still valid today, greatly popularised the use of open source in India. As part of Digital India, the Federal Digital Agenda for 2015-2025, numerous OSS solutions were elaborated for various Ministries, the most recent of which can be found on OpenForge, an Indian platform created in 2017 by the MeitY for the collaborative development of e-Governance applications.

Actors

This section presents the key governmental bodies that are responsible for setting OSS policies and the main strategic players that work together with the government at all levels to raise awareness on OSS.

Policy makers

- The Ministry of Electronics and Information Technology (MeitY) is responsible for all policy matters related to information technology, electronics, and the Internet. The MeitY is also responsible for the implementation of the Federal Digital Agenda, called Digital India.[1] All existing OSS policies have been set out by this Ministry.
- The Digital India Corporation (DIC) is a non-profit organisation set up by the MeitY and its role is to provide strategic direction and support in the framing of policies and in the implementation of the strategy for Digital India in different domains of e-Governance. The DIC also "provides strategic support to Ministries/Departments of Centre/States by promoting best practices, encouraging Public-Private Partnerships (PPP) and nurturing innovation and technology in various domains".[2]

[1] https://www.meity.gov.in/
[2] https://pib.gov.in/newsite/PrintRelease.aspx?relid=162044

- The National e-Governance Division (NeGD) is an independent business division under the DIC that was established by the MeitY. Its role is to participate in the implementation of Digital India by providing technical assistance and project management on e-Governance initiatives undertaken by ministries or departments.[3]
- The IT in Emerging Areas Division (ITEA) is the research and development division of the MeitY, specialised in emerging technologies, including OSS initiatives. One of the objectives of the ITEA is "to create and enhance value using Free and Open Source Software (FOSS) within the ICT framework in order to provide efficient, economical, secured and quality services".[4] Towards this goal, the ITEA works on the deployment of FOSS tools and technologies, but also human resources, training and support development in the era of FOSS.

Strategic players

- The National Resource Centre for Free and Open Source Software (NRCFOSS) is an organisation established by MeitY for R&D, HR development, awareness creation, support and adoption of OSS in India.[5] This organisation is jointly administrated by the national network of regional Centres for Development of Advanced Computing (C-DAC)[6] and by the research centre AU-KBC[7].
- The National Informatics Centre (NIC) was established in 1976 by the MeitY with the aim to provide technology-driven solutions to central and state governmental bodies for different aspects of technological development. The NIC provides nationwide ICT infrastructure to support e-Governance services and various initiatives of Digital India. The NIC is composed of a network of centres (data, states, focus, districts and centres of excellence). Among the focus centres, the Open Technology Group in Chennai is specialised in the theme of open technologies.[8]
- The Open Technology Centre (OTC) is a division of the NIC. The mission of the OCT is to facilitate the adoption of open technologies in e-Governance and provide strategic applications and services. As a national knowledge facility, its role is to support the NIC in its activities and to create a synergy between the overall components of open technology initiatives, such as OSS, that are being adopted in various communities (academics, R&D, science and technology, industry, etc.) in India.[9]
- The International Centre for Free and Open Source Software (ICFOSS) is an autonomous organisation set up by the State Government of Kerala and the FOSS community in the region with the mandate of popularising FOSS in Kerala and in India as a whole. To do so, they are

[3] https://negd.gov.in/
[4] https://www.meity.gov.in/content/it-emerging-areas-division
[5] https://www.meity.gov.in/content/competence-building-3
[6] https://www.cdac.in/
[7] http://www.au-kbc.org/#
[8] https://www.nic.in/state-office/
[9] https://www.meity.gov.in/content/open-technology-centre

collaborating with local, regional, national and international organisations/networks working in the FOSS domain.[10]

- The Open Tech Foundation aims to promote open technologies and innovation through education, including the use of OSS and open data.[11] It offers educational activities (in-person, online or custom trainings) and organises events on open technologies. The Foundation is active in three main areas: health, knowledge transformation and finance.

Policy and legal framework

This section summarises the main open source software related policies and legal acts of the last ten years, including the first known milestone in this domain. The list is presented in a chronological order, starting from the most recent milestone.

- Digital India (2015) is the main digital agenda of India, launched by the MeitY. Digital India has three main components: making government services digitally available to citizens through online infrastructure improvement, enhancing internet connectivity in all parts of India, and empowering the country in the domain of technology.[12] A report on the impact of this program, titled India's Trillion-Dollar Digital Opportunity was published in 2019, analysing the national digital transformation between 2015-2019 and outlining a roadmap for 2025. Digital India mentioned the use of openness in the realisation of several objectives, including the use of open source APIs, for example.[13]
- The Policy on Adoption of Open Software for Government of India (2015) aims to encourage the formal adoption and use of OSS in government organisations.[14] This policy has three main purposes: to provide a policy framework for the rapid and effective adoption of OSS, to ensure strategic control in e-Governance applications and systems from a long-term perspective and finally, to reduce the Total Cost of Ownership (TCO) of projects.
- The Framework for Adoption of OSS in e-Governance Applications (2015), in addition to the above policy, "provides a set of procedures and recommendations for promoting, managing, and adopting OSS as a potential option in e-Governance Systems".[15]
- The Policy on Collaborative Application Development by Opening the Source Code of Government Applications (2015) "provides a framework for archiving government custom developed source code in repositories and opening these repositories for promoting reuse, sharing and remixing".[16]

[10] https://icfoss.in/background
[11] https://www.opentechfoundation.in/
[12] https://digitalindia.gov.in/
[13] https://www.digitalindia.gov.in/ebook/MeitY_TrillionDollarDigitalEconomy.pdf
[14] https://www.meity.gov.in/writereaddata/files/policy_on_adoption_of_oss.pdf
[15] https://dot.gov.in/sites/default/files/2018_06_01%20OSS%20Policy%20of%20GoI%20for%20Adoption.pdf
[16] https://www.meity.gov.in/writereaddata/files/policy_government_application.pdf

- The Policy on Open Application Programming Interfaces (APIs) for the Government of India (2014) "sets out the government's approach on the use of open source APIs to promote software interoperability for all e-Governance Applications and Systems and provide access to data and services for promoting the participation of all stakeholders, including citizens".[17]
- The National Policy on Information Technology (2012) states that one of the goals is "to adopt open standards and promote open source and open technologies". The policy sought to ensure that ICT was within the reach of the whole of India, and to harness the capability and human resources of the country to enable it to emerge as the global hub and destination for IT by 2020.[18]

Open source software initiatives

This section presents an overview of the main open source software related initiatives in India. The list is presented in a chronological order, starting with the most recent initiative.

- Roundtable discussion on FOSS in Government, 2021[19]: This roundtable discussion is an initiative of the MeitY, organised in April 2021 in collaboration with Omidyar Network India, to provide a forum for e-Government leaders of states, central ministries and agencies to share their experiences, best practices and learnings from using FOSS in government technologies, platforms and applications.
- FOSS4GOV Innovation Challenge, 2021[20]: FOSS4GOV is a call-for-projects organised by the MeitY that is open to the FOSS community, entrepreneurs and Indian start-ups. Participants are invited to submit OSS ideas and innovations that could be implemented by the federal government in various areas, especially in health, education, agriculture and urban governance. The purpose of this initiative is to accelerate the adoption of FOSS in the Indian government.
- SmartCode Repository, 2021[21]: Smart Code Repository is an open source platform developed for the Ministry of Housing & Urban Affairs (MoHUA). This project is "designed to address the challenges faced in the development and deployment of digital applications linked to urban affairs, by enabling cities to take advantage of existing codes and customising them to suit local needs, rather than having to develop new solutions from scratch".[22]
- Open GIS platform, 2019[23]: The Open GIS platform is an initiative developed by the MeitY and the NeDG for the National Centre of Geoinformatics, a Geographic Information System (GIS)-based decision support system platform. In line with Digital India, the National Centre of

[17] https://www.meity.gov.in/sites/upload_files/dit/files/Open_APIs_19May2015.pdf
[18] https://www.meity.gov.in/writereaddata/files/National_20IT_20Policyt%20_20.pdf
[19] https://www.devdiscourse.com/article/headlines/1545669-meity-holds-discussion-on-free-and-open-source-software-in-government
[20] https://techobserver.in/2021/04/25/meity-launches-free-and-open-source-software-innovation-challenge/
[21] https://smartnet.niua.org/smartcode/#about
[22] https://pib.gov.in/PressReleasePage.aspx?PRID=1700246
[23] https://openforge.gov.in/openforge/opengis.php

Geoinformatics supports 550 different projects for 29 central, ministerial and departmental agencies, all using OSS.[24]

- Unified Mobile Application for New-age Governance (UMANG), 2017[25]: UMANG is an application developed by the MeitY and the NeGD to lead mobile governance in India. This initiative aims "to provide a single platform for all Indian citizens to access pan-India e-Government services ranging from Central to Local Government bodies". The architecture of the application is based on open standards.[26]
- e-Pramaan, 2017[27]: e-Pramaan is an e-Authentication framework developed by C-DAC, which facilitates multi-factor strong authentication process for users accessing various services using mobile or fixed platforms, including e-Government services. e-Pramaan offers a multi-factor authentication (password, OTP, digital certificate and biometrics) and additional features for services such as a configurable chaining of authentication factors, website authentication, Aadhaar-based user identity verification, etc.
- OpenForge, 2017[28]: OpenForge is an Indian platform developed by the MeitY and the NeGD for the open collaborative development of e-Governance applications. OpenForge is intended specifically for e-Governance applications and allows two types of collaborations: Government to Community (projects are created in public mode by either government or OSS community members) or Government to Government (projects are created in a controlled mode by government agencies/members only).
- Bharat Operating System Solutions (BOSS), 2016[29]: BOSS is an Indian version of GNU/Linux-based localised operating system distribution developed by C-DAC (Chennai) and released under GPL (General Public License). BOSS is customised to suit India's digital environment and supports 18 Indian languages. C-DAC also developed an educational variant of BOSS, called EduBOSS, which comes with a set of useful features for primary and secondary schools.[30] Furthermore, a light-weight version of BOSS, "BOSS Server", has also been developed for SMEs and government organisations to host their website and internal servers.
- e-Basta, 2016[31]: In line with Digital India, the e-Basta project provides a framework to make schoolbooks accessible in digital form as e-books, bringing students, teachers and publishers together on the same platform. C-DAC (Mumbai), the research centre responsible for the project, has also developed an app for students to easily navigate on the platform.

[24] https://ncog.gov.in/index.html
[25] https://web.umang.gov.in/landing/
[26] https://negd.gov.in/sites/default/files/tender/UMANG-BE%20RFP_Final_0.pdf
[27] https://www.epramaan.gov.in/whatisepramaan.html
[28] https://openforge.gov.in/
[29] https://bosslinux.in/
[30] https://www.cdac.in/index.aspx?id=st_pr_EduBoss_gnu_linux
[31] https://www.cdac.in/index.aspx?id=st_el_eBastaUpdate

- Government e-Marketplace (GeM), 2016[32]: GeM is a contactless, paperless, and cashless online marketplace. The platform aims to increase transparency, efficiency, and speed in the public procurement of goods and services by central and state government organisations. The use of the platform "has led to overall savings in government expenditure while enhancing transparency and efficiency in public procurement, leading to a significant impact on lowering the Indian fiscal deficit. A transparent public procurement system not only improves the government functioning but also helps boosting collaboration and innovation within the private sector".[33]
- DigiLocker, 2015[34]: DigiLocker is a flagship initiative of the MeitY under the DIC based on open source technologies. Under the scope of Digital India, this initiative acts as a "citizen's digital document wallet" and aims at the digital empowerment of citizens by providing them with easy access to authentic and official digital documents.
- Anumaan, 2015[35]: Anumaan is an open source, on-screen predictive text entry system developed by C-DAC (Mumbai) to help people with motor disabilities or other learning disabilities with the use of computer equipment. The Anumaan system has been integrated with the Linux desktop and is also available as a standalone tool.
- e-Svaasthya, 2015[36]: e-Svaasthya is a web-based Hospital Information System (HIS) developed by C-DAC (Mumbai). The initiative aims to enhance the computerisation of all the activities of the hospital (patient registration, online consultations, ward management, etc.) and the sharing of data across different Indian regions. Beyond patient-doctor interactions management, e-Svaasthya also provides a complete functionality suite for other departments of the hospital (Pharmacy, Radiology, Blood Bank, Pathology, Ambulatory, etc.).
- MeghSikshak, 2015[37]: C-DAC (Hyderabad) developed an e-learning platform that can be used for Massive Open Online Courses (MOOC) or more broadly, online courses. It is frequently used by police offices, law enforcement agencies and in the training of government officers as part of the Information Security Education Awareness program (ISEA). The purpose of the solution is to "provide flexibility for customisation, scalability and high availability for offering various e-learning services without the need for hardware and software resources at end user premises".[38]
- Electronic Public Distribution System (ePDS), 2015[39]: ePDS is an open source and user-friendly application developed by the NIC for the Ministry of Consumer Affairs, Food and Public Distribution. The purpose of the ePDS is to facilitate the supply management of food grains and the distribution of essential commodities to low-income citizens through a network of "Fair Price

[32] https://www.centreforpublicimpact.org/case-study/indian-governments-e-marketplace-gem
[33] https://www.centreforpublicimpact.org/case-study/indian-governments-e-marketplace-gem
[34] https://digilocker.gov.in/
[35] https://sourceforge.net/projects/anumaan/
[36] https://sourceforge.net/projects/esvaasthya/
[37] https://www.cdac.in/index.aspx?id=st_el_meghsikshak
[38] https://www.cdac.in/index.aspx?id=st_el_meghsikshak
[39] http://epds.nic.in/

Shops" in the country. The application also contains a ration card management system (used for the creation of a new card and for modification, storage, and printing requests).

- e-Sikshak, 2014[40]: e-Sikshak is an open source and multi-lingual e-Learning environment developed by C-DAC (Hyderabad). The program is used by various educational institutions in the Hyderabad area. The software offers various educational features, such as a course organiser, a whiteboard interface, an online assessment tool, and additional useful tools (a bulletin board, an internal chat, an email system, and a personal space for students).
- Enhancing Accessibility for FOSS Desktops, 2013[41]: This project led by C-DAC (Mumbai) under the NRCFOSS aims "to produce reusable and accessible software solutions as per the specific needs of disabled people having visual, physical and cognitive impairments". The project includes a predictive writing tool, a screen reader, the development of speech-based input mechanisms and the global adaptation of the desktop to meet the needs of people with disabilities.[42]
- M.Sc (CS-FOSS) Program, 2012[43]: The Anna University Chennai, with the collaboration of the AU-KBC Research Centre, launched an online master's degree program in computer science, focused on FOSS. The two-year program, delivered entirely online, focuses on learning a wide variety of tools, products, technologies and approaches specific to the FOSS movement.
- Swar-Suchak, 2011[44]: The C-DAC team of Delhi has developed an open source voice enabled information retrieval system for mobile phones with various features (automatic speech recognition, translation, web navigation system, weather information, etc.). "The voice gateway successfully integrates the mobile phone network with an automatic speech recognition system, Hindi and English text-to-speech system and an open standards-based web navigation system using only open source software."[45]
- Spoken Tutorial, 2010[46]: The Spoken Tutorial project is an open source and community-based educational content portal, developed by IIT Bombay for the Indian Ministry of Education. This initiative, funded by the National Mission on Education through Information and Communication Technology (ICT), aims to promote IT literacy through OSS. It includes online courses and tutorials on FOSS, as well as online tests. They are also conducting workshops and certificates can be given to those who complete software courses.

[40] https://www.cdac.in/index.aspx?id=st_pr_esikshak
[41] https://cdac.in/index.aspx?id=aboutus_skoch_foss_olabs_parikshak
[42] https://www.cdac.in/index.aspx?id=st_ict_Enhanc
[43] http://cde.annauniv.edu/Default9.aspx
[44] https://ieeexplore.ieee.org/document/5972474
[45] https://www.researchgate.net/publication/221560901_Voice_Enabled_G2C_Applications_for_M-Government_Using_Open_Source_Software
[46] https://spoken-tutorial.org/

- GNU Compiler Collection Centre (GCC), 2008[47]: The Indian Institute of Technology Bombay created in 2008 this centre to support the open source movement by providing training, workshops and technical know-how regarding the GCC framework to academia and industry.
- Open Source Drug Discovery (OSDD), 2008[48]: The OSDD project is an OSS initiative led by the Council of Scientific and Industrial Research (CSIR) of the Indian government, as a research platform to develop an affordable healthcare, enhance drug discovery and research new treatments for neglected tropical diseases like tuberculosis or malaria. As a transnational platform, it brings together various actors of the health sector (e.g. students, scientists, doctors, hospitals, etc.).
- Integration of the OSS Koha in all District Central libraries (Kamill District)[49]: Koha is an open source Library Management System created in 1999 in New Zealand[50]. The Tamil district decided to implement Koha in every library of the region to support all housekeeping operations in libraries and to list and manage book collections in the database management system.
- Dhara[51]: As part of NRCFOSS project, the Indian Institute of Technology Madras has developed a service-oriented architecture (SOA) for Kernel services. "Dhara conceives an operating system (OS) as being constructed by multiple stacks of services containing several layers of abstracted services with the aim of increasing the capacities of hardware".[52]
- ASA-AUA Services for Aadhaar Based Authentication and e-KYC[53]: The objective of this open source initiative is to provide instant verification and identification of residents against the available data in Central Identities Data Repository (CIDR) of the Unique Identity Development Authority of India (UIDAI). Based on needs of the service, different identifiers could be used in combination with the Aadhaar unique identification number, such as biometrics (finger or iris), demographic information (address, birth date, etc.) or/and a secret code.
- eSangam[54]: eSangam is an e-Governance Services Integration Framework developed by C-DAC. Its objective is to provide a standardised interfacing and seamless message exchange among various government portals. This solution aims to respond to the need for the Government of India to cooperate, collaborate and integrate information across different departments in the central, state and local governments.
- Free/Libre and Open Source Software for Education (FOSSEE)[55]: The FOSSEE project promotes the use of FOSS tools in academia and research. This project is part of the National Mission on

[47] http://www.cse.iitb.ac.in/grc/index.php?page=home
[48] http://www.osdd.net/home
[49] https://cutn.ac.in/central-library/
[50] https://koha.org/
[51] https://www.meity.gov.in/content/major-foss-initiatives
[52] https://ieeexplore.ieee.org/document/6299208
[53] https://www.cdac.in/index.aspx?id=st_aba_asaaua
[54] https://esangam.gov.in/
[55] https://fossee.in/

Education through Information and Communication Technology (ICT), conducted by the Ministry of Education.

- Meghdoot[56]: Meghdoot is a developed cloud suite using free and open source software to offer cloud services to Indian citizens. Created by C-DAC Chennai in collaboration with the OpenStack Foundation, the purpose of the Meghdoot solution is to transform a conventional data centre into a cloud environment.
- IT@School Project/Kerala Infrastructure and Technology for Education (KITE)[57]: The IT@School project is an initiative created by the Department of General Education of the State Government of Kerala, which aims to improve IT education in schools and the quality of the education by fostering a complete ICT-enabled educational system based on OSS. Due to its significant success, the IT@School project was transformed in 2017 into a Special Purpose Vehicle (SPV) Company, named "KITE" (Kerala Infrastructure and Technology for Education), by the State Government in order to extend its field of action to higher education.

[56] https://www.cdac.in/index.aspx?id=cloud_ci_cloud_computing
[57] https://www.ndtv.com/education/kerala-governments-it-school-project-formed-into-government-company-as-kite-1734509