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ICITEE 2014

"Leveraging Research and Technology through University-Industry Collaboration"

Eastparc Hotel, Yogyakarta
7-8 October 2014

Organized by
Department of Electrical Engineering and Information Technology
Faculty of Engineering, Universitas Gadjah Mada
Jalan Grafika 2 Yogyakarta 55281, Indonesia

Welcome Message from the General Chair

On behalf of the organizing committee, it is our pleasure to welcome you to Yogyakarta, Indonesia, for our annual conference. This is the 6th conference that is held by the Department of Electrical Engineering and Information Technology, Faculty of Engineering, Universitas Gadjah Mada. This year, the conference is differently called as Joint conference 2014 as there will be 4 parallel conferences, including:

1. ICITEE (International Conference of Information Technology and Electrical Engineering) 2014,
2. CITEE (Conference of Information Technology and Electrical Engineering) 2014,
3. RC-CIE (Regional Conference on Computer and Information Engineering) 2014, and
4. CCIO (Conference on Chief Information Officer) 2014.

The joint conference's theme is "Leveraging Research and Technology through University-Industry-Government Collaboration" emphasizes on the enhancement of research in a wide spectrum, including information technology, communication and electrical engineering, as well as e-services, e-government and information system. The conference is expected to provide excellent opportunity to meet experts, exchange information, and strengthen the collaboration among researchers, engineers, and scholars from academia, government, and industry.

In addition, the conference committee has invited five renowned keynote speakers, Prof. Marco Aiello from University of Groningen (RuG), Netherland, Prof. Einoshin Suzuki from Kyushu University, Prof. Yoshio Yamamoto from Tokai University, Prof. Jun Miura from Toyohashi University of Technology, and Prof. Kazuhiko Hamamoto from Tokai University, Japan. The conference committee also invited Tony Seno Hartono from National Technology Officer of Microsoft Indonesia and Dr. Ing. Hutomo Suryo Wasisto (Associate Team Leader in MEMS/NEMS and Sensor Group) Technische Universität Braunschweig, Germany as Invited speaker to present their current research activities.

This conference is technically co-sponsored by IEEE Indonesia Section. Furthermore, it is supported by JICA, AUN/SEED-Net, Ministry of Communication and Information Technology of The Republic of Indonesia, and King Mongkut's Institute of Technology Ladkrabang, Thailand.

As a General Chair, I would like to take this opportunity to express my deep appreciation to the organizing committee members for their hard work and contribution throughout this conference. I would also like to thank authors, reviewers, all speakers, and session chairs for their support to Joint Conference 2014.

In addition to the outstanding scientific program, we hope that you will find time to explore Yogyakarta and the surrounding areas. Yogyakarta is city with numerous cultural heritages, natural beauty, and the taste of traditional Javanese cuisines, coupled with the friendliness of its people.

Lastly, I would like to welcome you to Joint Conference 2014 and wish you all an enjoyable stay in Yogyakarta.

Sincerely,

Hanung Adi Nugroho, Ph.D.
General Chair of Joint Conference 2014

Welcome Message from the TPC Chair

On behalf of the technical program committee (TPC), we warmly welcome you to the 6th International Conference on Information Technology and Electrical Engineering (ICITEE 2014) in the cultural city of Yogyakarta, Indonesia. The committee has organized exciting technical programs for ICITEE 2014 with conference theme of "Leveraging Research and Technology through University-Industry Collaboration." As an annual International conference, ICITEE provides excellent platform to share innovative idea and experiences, exchange information, and explore collaboration among researchers, engineers, practitioners and scholars the field of information technology, communications, and electrical engineering.

All 163 submitted papers from 18 countries throughout the world went through a rigorous review process and each paper was evaluated by at least three independent reviewers in accordance with standard blind review process. Based on the results of the rigorous review process, 78 papers have been selected, which constitute the acceptance rate of 47.9%. These papers have been grouped into 5, ranging from the fields of information technology, communications, power systems, electronics, and control systems. Besides those regular sessions, ICITEE 2014 also features world-class keynote/plenary speeches and distinghuish-invited speakers that reflect the current research and development trends in the aforementioned fields.

We are deeply indebted to all of our TPC members as well as our reviewers, who volunteered a considerable amount of their time and expertise to ensure a fair, rigorous, and timely review process. Many thanks should be given to our keynote and invited speakers who will share their experience in this conference. Last but not least, our sincere gratitude should be given to all authors for submitting their work to ICITEE 2014, which has allowed us to assemble a high quality technical program.

Welcome to Yogyakarta and hope you will enjoy a wonderful experience in this traditional city of Indonesia.

With best regards,

TPC Chair

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Statistical Analysis of Popular Open Source Software Projects and Their Communities

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***Abstract*— Open Source Software (OSS) becomes one of the mainstream software development methodology competing with commercial and proprietary software development. One of the distinct characteristics of OSS projects is the existence group of contributors who joined the project voluntarily called OSS Communities. In this study, the statistical analysis of 263 popular OSS Projects and their communities is performed. The popularity of the OSS Projects is determined from suggestion from selected websites found from Google search engine. The analysis covers information such as OSS Project's name, description, category, repository, community type, number of contributors, and the start year. There are four important findings of the statistical analysis. First finding is that most of the category of the OSS Projects is computer and networking related. The other findings are that most of the project is in Ad Hoc state and the different trends in the number of contributors in Foundation and Commercial Company of OSS Communities. The last finding is that most of the OSS Projects are using Github, Sourceforge and Ohloh as their source code repositories. These results provide important insights about the structure and activities of OSS Projects and their communities.**

Keywords—Open Source Software Project; community; statistical analysis; popular

I. INTRODUCTION

Open Source Software (OSS) has evolved into one of the mainstream software development methodology challenging the already established software engineering methodology used by proprietary and commercial software projects. The OSS products such as Firefox web browser, Apache web server, Android operating system and many more have placed themselves as the major players and benchmarks for other similar applications. Besides these successful projects, there are many OSS Projects are created everyday and some of these projects eventually will evolve into medium to large projects which are developed by many groups of contributors.

One of the distinct characteristics of OSS project is the ability for everyone to download, improve and modify the source code. This characteristic enables the project to attract many contributors to voluntarily contribute to the development of the software project in the form of a group called OSS Communities. Some of the big names of OSS Projects such as Apache Foundation, Mozilla Developer Network, Linux Foundation, and Eclipse Foundation have become the icons of success of OSS Communities. Studies have shown that the success of OSS Projects are largely depends on the success of their communities.

The OSS Communities comes into many shapes and forms which are interesting to be studied and examined. The knowledge about characteristics of OSS Projects and their communities provides interesting insight about their secret of success. This paper describes the statistical analysis of 263 "popular" OSS Projects and their communites which includes the project's name, description, category, repository, community type, number of contributors, and start year of the projects. The result of this study should be beneficial in understanding the internal structure and activities in these OSS Projects and their communities.

II. CURRENT STUDIES

OSS is a software development methodology with several distinct characteristics:

- Everybody can download, improve and modify the source code [1].
- Developers or programmers for this project are recruited voluntarily. They will then form a group of developers called OSS Community. The community will evolve from a single developer into a complex organization [2].
- The software system and the community of OSS projects are co-evolved [3].

Many popular OSS Projects have been the subject of research in order to understand their successes. Several examples of successful OSS projects being studied such as Apache [4][5], Debian GNU/Linux [6], Mozilla [4][7], FreeBSD [8], JFreeChart [9], etc. Several success factors of these projects have been identified such as the modularity of the source code [10][11], the active and effective role of the team members [12], proper planning from core developer at the beginning of the project [13], sufficient number of developers [14][15] and the transparent flow of information [16], experienced developers [17], and the more open governance approach [18].

The software system development process of some OSS Projects also has been studied to understand their internal

characteristics and problems. Stewart *et al* studied 1000 releases of 200 OSS projects to understand the effect of the source code complexity against the interest of the new developer [19]. Alsmadi and Magel have studied the LOC efficiency of several OSS projects that they found that the range of LOC efficiency are 70% - 80% and the function size are 20 – 30 LOC [20]. The problems faced by OSS projects such as resource allocation and budgeting [21], and the lack of mechanism to manage the growth of the project [22].

The uniqueness of the OSS Communities is also the subject of several studies in order to understand their internal structure and motivations. For a small OSS projects the hierarchy of the community are usually simple which is consisted of two roles called core and associate members or developer and handyperson [23][24]. Meanwhile, for a larger OSS projects, the structure of the community are more complex which consisting up to 8 roles called project leader, core member, active developer, peripheral developer, bug fixer, bug reporter and passive user [25]. The hierarchy of the OSS community is in the form of onion layer [26] or 5 layers open onion model [27]. Whereas the motivations of each developers in joining the community varies but it can be categorized into internal and external motivations [28][29].

This study is different from the previous studies in which the focus is the statistical study of the characteristics and communities of "popular" OSS projects. The popularity of the projects is based on recommendations from selected websites found from Google Search Engine by feeding some search strings indicating popularity. There are 263 popular OSS Projects are collected and examined further by gathering more detailed information from the project's websites, their repositories, project's community website, etc. The information collected from those OSS Projects is taken during the months of May to June 2014.

III. RESEARCH METHODOLOGY

The research methodology used in analyzing these OSS Projects and their communities is divided into three phases:

1. Determining the "popular" OSS Projects: the selection of OSS Projects that are considered popular to be examined further.
2. Collecting information of each of the popular OSS Projects: collecting information from each OSS Projects from project's websites, community websites, repositories, etc.
3. Statistically analyzing the information collected: analyzing statistically the information collected in order to find meaningful insight.

The following subsections describe the detail of each of the phases.

A. DETERMINING POPULAR OSS PROJECTS

The first step of the research is to determine which OSS Projects are considered "popular". Based on online dictionaries such as Merriam-Webster, Dictionary.com, and The Free Dictionary, the term "popular" is related to the likeness to majority of people. Google search engine is used in finding these projects by using keywords such as "popular Open Source Projects", "best Open Source Projects", etc. There are many websites suggesting popularity of OSS Projects, but after carefully reviewing the website's content and the reputation of the website the list of websites are shortlisted into 8 websites. The websites used as the reference of the popularity of the OSS Projects are:

1. Infoword's Bossie 2013 Award [31].
2. "Best Open Source Software" from Lifehacker.biz website [32].
3. "Top 10 Open Source Projects" by V3 Staff at V3.com website [33].
4. "30 Cool Open Source Software I Discovered in 2013" by Nixcraft at Nixcraft.com website [33].
5. "Best of Opensource.com: Top 10 open source projects in 2013" at Opensource.com website [34].
6. "Open Source Windows" at Opensourcewindows.org website [35].
7. "30 Essential Pieces of Free (and Open) Software for Windows" by Trent at thesimpledollar.com website [36].
8. "Most popular open-source projects hosted at GitHub" by Dan Nanni at xmodulo.com website [37].

Most of the OSS Projects recommended from these websites are redundant and then compiled into 263 OSS Projects. The following is the list of the selected popular OSS Projects being analyzed in this research shown in compressed alphabetical ordered list:

@SSP,]project-open[, {less}, ABC, Abiword, AC3Filter, Ack-grep, Activiti, Adminer, Alfresco, aMSN, Android, Android, Angry IP Scanner, AngularJS, Apache Cordova, Apache Drill, Apache Giraph, Apache Hadoop, Apache Hama, Apache HTTP Server, Apache Shiro, Apache Sqoop, AppServ, Arduino, Artica, Audacity, Backbone.js, BBurst!, BigBlueButton, Bitcoin, BitPim, BitTorrent, Bonita BPM, Bootstrap, Brackets, BT++, Cabos, Chosen, Chromium, Cinnamon, ClamWin, Classic Shell, Clonezilla, Cloud Foundry, Cloudera Impala, Coppermine Photo Gallery, Couchbase Server, cURL, CyanogenMod, D3: Data-Driven Documents, DC++, DD-WRT, Debian, DeskWeb, Dev-C++, Ditaa, Django, DocHive, Docker, DokuWiki, DOSBox, DotNetNuke, Drupal, EasyPHP, EasyTAG, Eclipse, Elastix, Ember.js, Emscripten, eMule, Enyo.js, Eraser, ERPNext, Eucalyptus, Express, FFDShow, FileZilla, Firebird, Firefox, Firefox, Firefox OS, Fluxbox, Font Awesome, ForgeRock, Foundation, FoxyProxy, Freemind, FrontAccounting, Gallery, GanttPV, Gephi, Ghostscript, GIMP, GitLab, GLPI, Gnome, GNU Parallel, GnuCash, Gnucleus, HandBrake, HealthMonitor, Hibernate ORM, Homebrew, HTML5 Boilerplate, Impress.js, inBloom, Inkscape, IPCop Firewall, IPython, ISPConfig, jEdit, Jekyll, Jenkins CI, Joomla, jQuery, jQuery File Upload, Juice, Kali Linux, KeePass, Keynote-nf, Koha, Kurogo, LAME, LibreOffice, Linux Kernel, luckyBackup, Maltego, MariaDB, MediaCoder, MediaGoblin, MediaPortal, MediaWiki, MiKTex, Miranda, Miro, Miro Video Converter, Moment, MongoDB, Moodle, Moosic, MP3Gain, MPC-HC, MPlayer, Mule ESB, MusikCube, MySQL, NASA Worldwind, Neo4j, Nginx, Nmap, Node.js, Notepad++, Notepad2, Observium, Odoo, Oh My Zsh, Onion Browser, Open Compute Project, Open edX, Open Source Beehives, Open Studio for Big Data, OpenBravo, OpenCMS, OpenDaylight, OpenEMR, OpenOffice.org, OpenShift, OpenShot, OpenStack, OpenVPN, OpenWrt, OrangeHRM, Orbot, Owncloud, Paint.NET, pdfcreator, PeaZip, PeerGuardian,

Pentaho BI, PhoneGap, phpBB, phpMyAdmin, phpSysInfo, Pidgin, Plone, PortableApps, PostgreSQL, Prey, Process Hacker, Process Maker, ProjectLibre, Python, Python, RackTables, Rails, Raspberry Pi, RedPhone, Replicant, RSSOwl, Rubrica, Ruby, Saltstack, Scala, SciDB, Scrollout F1, ScummVM, Serengeti, Service Stack, Shareaza P2P, SharpDevelop, SimpleInvoices, SiSU, Speed Dreams, SquirreL SQL, StepMania, StreamRipper, SugarCRM, SwitchYard, TEA, TeXnicCenter, TextSecure, Three.js, Thunderbird, TightVNC, Tmux, TortoiseSVN, Trinket, True Combat: Elite, Tuleap, Turnkey Linux, Ubuntu, Ultimate++, UltraVNC, Unetbootin, Varnish, VirtuaDub, VLC Media Player, Vtiger, Vuze, WAMP5, WDM, Webkit, Webmin, Wine, WinSCP, Wireshark, Wordpress, Workrave, WURFL, wxWidgets, X3DOM, XAMPP, X-Chat 2, Xine, XOOPS, xTuple, Zanata, Zentyal Server, Zile, ZSNES.

B. *COLLECTING INFORMATION FROM EACH OSS PROJECT*

Based on the list of popular OSS Projects, the next step is collecting information from each of the 263 OSS Projects. The information is collected from the projects' official websites, project's repository, and other relevant information from other websites. The information collected from each of the OSS Projects with its remark is described in Table I.

TABLE I. INFORMATION COLLECTED FROM OSS PROJECTS

Information	Remark
Name	The official name of the OSS Project
Description	Short description of the OSS Project
Category	Category of the OSS Project
Host	URL link of the OSS Project
Repository	Source Code Repository used by the project
Community Name	The official name of the OSS Community
Community Type	Type of the OSS Community
Number of Contributors	The number of contributors
Project's Start Year	The start year of the OSS Project

All information stated in Table I is collected directly from OSS Project's website and its repositories except for Category and Community Type. The Project's Category is inferred from project's description, whereas the Community Type is inferred from the description and activity of the community and its product's offering.

IV. RESULT OF STATISTICAL ANALYSIS

Statistical analysis is conducted of all the information collected from 263 popular OSS Projects to find meaningful insight and interesting patterns. There are five significant observations found from the analysis:

1. OSS Project Categories
2. OSS Community Types
3. Contributors of OSS Projects
4. OSS Project Repositories
5. OSS Project Start Year

The details of the observations are detailed in the following subsections.

A. *OSS PROJECT CATEGORIES*

The description and other informations from the OSS Project's websites are examined to determine the categories of each of the project. Each of the projects is then categorized into 14 groups which are Networking System, Multimedia, Web Design, Software Development, Utilities, Business, Databases, Productivity, Internet Applications, Operating Systems, Education, Security, Embedded System, and Health. Fig. 1 shows the distribution of the OSS Projects' categories.

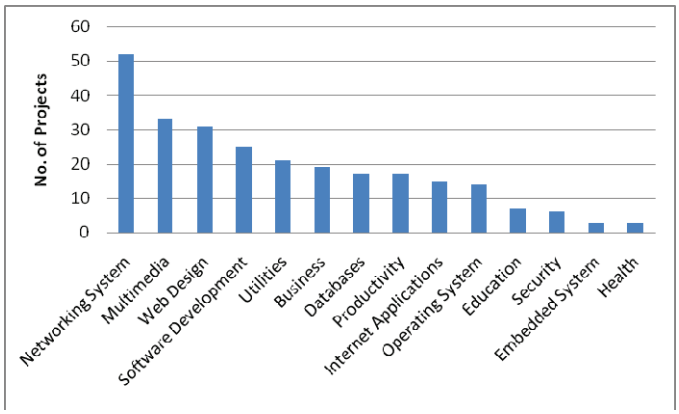

Fig. 1. OSS Projects by Category

Fig. 1 shows that most of the OSS Projects are related to computer and networking related applications (Networking System, Web Design, Software Development, Utilities, Databases, Internet Applications, Operating System, and Security). Multimedia applications also has significant number along with business related applications (Business and Productivity). Projects categories in Education, Health and Embedded System are still in small proportions. This observation indicates that the majority of users / customers of OSS Projects are person who involved in computer and networking related areas, while the users in other areas are still in small proportions.

B. *OSS COMMUNITY TYPES*

The driving force of the OSS Projects is their communities. An OSS Project is usually initiated by one or more person who is organized intially in informal manner or Ad Hoc. As the number of contributors increased, the need for more formal types of organization which clear structure and responsibilities arises. These organizations may evolve into two types of organization which are Foundation / Non-formal organization and Commercial Company. Some community organizations become a Foundation / Non-formal organization if they decided to remain non-profit, while they may also become a commercial company if they decided to commercialize some aspects of their software products or supports. Based in how the communities are developed, they are categorized into 3 typesm of OSS Communities, which are:

1. Ad Hoc: there is no informal structure in the community, every contributors are in the same level of roles and responsibilities. This state of organization is usually in the early form of OSS Communities.
2. Foundation / Non-profit organization: the community has formal structure of role hierarchy and responsibility, but they continue to have non-profit orientation. The form of community may remain informal or become foundation.
3. Commercial Company: the community has formal structure of role hierarchy and responsibility. This organization offers both free or community versions of the software system and the paid versions with professional support.

Table II shows the types of OSS Communities of the 263 popular OSS Projects based on the examination of their activities and product offerings.

TABLE II. TYPES OF OSS COMMUNITIES

Organization	No. Of Project
Ad Hoc	166
Foundation / Non-profit organization	45
Commercial Company	52

Table II shows that most of the OSS Communities (about 63%) are still in Ad Hoc state indicated by unstructured roles and responsibilities among those contributors. The second largest category is Commercial Company for about 19.8%. The third category is Foundation / Non-profit organization for about 17%. Some of the noticable names of Foundation / Non-profit organizations are Apache Software Foundation, The Gnome Foundation, The Eclipse Foundation, Debian Organization, Hibernate Community, Sharp Develop Community, etc.

C. CONTRIBUTORS OF OSS PROJECTS

Contributors are persons who participate to the OSS Projects in many forms of contributions. Most of the contributions are in the source code development, translation, documentation, etc. Table III shows the classification of the number of contributors of the 263 popular OSS Projects.

TABLE III. CONTRIBUTORS OF OSS PROJECTS

No. Of Contributors	No. Of Project
1 - 30	134
31 - 100	56
101 - 400	40
> 400	30

Table III shows most of the OSS Projects are supported by small groups of contributors (1 – 30 contributors). The number of OSS Projects supported by larger groups of contributors decreases indicating the increased difficulty in managing larger contributors who almost never meet face to face and only communicate through online channels.

The size of the contributors in OSS Projects can be correlated with the types of communities as discussed in Table II. Table IV shows the size of contributors in Ad Hoc OSS Communities.

TABLE IV. CONTRIBUTORS OF AD HOC OSS COMMUNITIES

No. Of Contributors	No. Of Project
1 - 30	93
31 - 100	36
101 - 400	22
> 400	13

Figure IV shows that most of Ad Hoc OSS Communities are supported by small number of contributors (no more than 30 contributors). Since in Ad Hoc communities there are no explicit roles and responsibilites for each contributors, the overall contribution may become difficult to manage as the number of contributors becomes larger.

The correlation of the number of contributors in Foundation / Non-profit Organization is shown in Table V.

TABLE V. CONTRIBUTORS OF FOUNDATION/NON-PROFIT ORGANIZATION OF OSS PROJECTS

No. Of Contributors	No. Of Project
1 - 30	17
31 - 100	4
101 - 400	12
> 400	12

Table V shows that for Foundation / Non-profit Organization are more suitable to larger groups of contributors in OSS Projects. This is due to the fact that in more formal types of organization such as Foundation or Non-profit organization, the roles and responsibilities are stated explicitly. The explicit roles and responsibilities enables each members of large organization to contribute positively with minimal conflict and overlapping.

The correlation of the number of contributors in Commercial Company OSS Project is shown in Table VI. Table VI shows that for OSS Community that becomes commercial company usually has small groups of contributors in order to remain competitive and manageable.

TABLE VI. CONTRIBUTORS OF COMMERCIAL COMPANY OSS PROJECTS

No. Of Contributors	No. Of Project
1 - 30	24
31 - 100	16
101 - 400	6
> 400	5

D. OSS PROJECT REPOSITORIES

All of the 263 popular OSS Projects will use one or many repository portals to maintain their source code and other documentations. Some of the OSS Projects may use more than one portal or may choose to use their own website as their own source code repository. Table VII shows the utilization of repositories by these popular OSS Projects.

TABLE VII. REPOSITORIES OF OSS PROJECTS

Repositories	No. Of Projects
GitHub	85
Sourceforge	68
Own (project's own website)	29
Ohloh	21
Sourceforge, Ohloh	16
Google Code	10
Launchpad	10
Sourceforge, GitHub	10
GitHub, Ohloh	5
Sourceforge, GitHub, Ohloh	2
Sourceforge, Launchpad	2
Sourceforge, Launchpad, Ohloh	2
Launchpad, Ohloh	1
Launchpad, Sourceforge	1

Table VII shows that the three most popular repositories are GitHub, Sourceforge, and Ohloh, while some of the OSS Projects are using its own website by utilizing version control applications. The other repositories such as Google Code and Launchpad are used in some of these projects.

E. OSS PROJECTS START YEAR

The OSS Projects start year are recorded to examine the age of the project and its relation to other recorded attributes. Fig. 2 shows the classification of start year of OSS Projects.

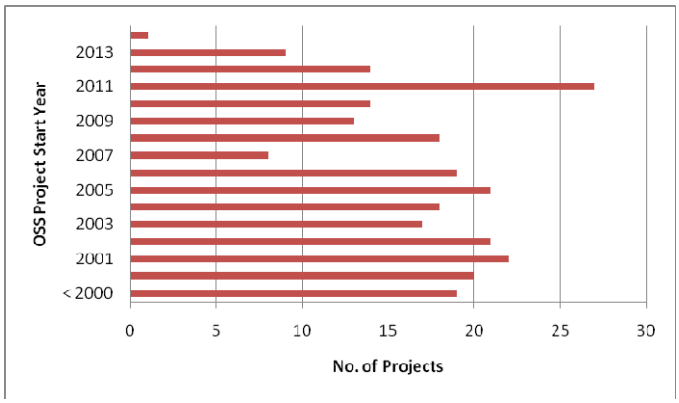

Fig. 2. OSS Projects Start Year

Fig. 2 shows that there is possible correlation between the age of the project and their popularity. In 2011 showing a significant number of popular OSS projects which related to the emergence of new web technologies such as Javascript, Web Framework, etc. The lowest number of popular OSS Projects are in 2007 in which there are only 8 popular projects that are started in 2007 compared to the average of 17 projects / year. There is one popular OSS Project that started in 2014 that is OpenDaylight.

V. CONCLUSION

OSS Projects becomes one of the mainstream software development methodologies competing with the proprietary / commercial software engineering. The OSS Projects consisting of two co-evolved components which are the OSS System and OSS Community. The analysis of the 263 popular OSS Projects and their communities may provide important insight to better understanding of their popularity and success.

It can be concluded based the statistical analysis of 263 popular OSS Project that:

1. Most of the project's categories are in the computer and networking related applications and only small proportion in business, education, and health.
2. Most of the OSS Communities are in Ad Hoc state (non formal and non structured) indicating that most of the projects are not properly managed.
3. The contributors of OSS Projects are in small number in each project (mostly below 30 contributors). Foundation / Non-profit organization usually suitable for more structured large group of contributors, while Commercial Company of OSS Communities remains in small number of contributors.
4. The top three OSS Project repositories are Github, Sourceforge and Ohloh.

The future work of this research is analyzing the evolution of larger numbers of OSS Projects and their communites based on many attributes so that the framework of the growth and evolution of OSS Projects, systems, and communites can be mapped so the ideal pathways of development of OSS Projects could be measured and identified.

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