

# Are FLOSS developers committing to CVS/SVN as much as they are talking in mailing lists? Challenges for Integrating data from Multiple Repositories \*

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## ABSTRACT

This paper puts forward a framework for investigating Free and Open Source Software (F/OSS) developers activities in both source code and mailing lists repositories. We used data dumps of fourteen projects from the FLOSSMetrics (FM) retrieval system. Our intentions are (i) to present a possible methodology, its advantages and disadvantages which can benefit future researchers using some aspects of the FM retrieval system's data dumps, and (ii) discuss our initial research results on the contributions developers make to both coding and lists activities.

## Categories and Subject Descriptors

H.4 [Information Systems Applications]: Miscellaneous;  
D.2.8 [Software Engineering]: Metrics—*complexity measures, performance measures*

## General Terms

Open Source Software

## Keywords

Free/Open Source Software Development, Software Repositories, Concurrent Versions System, Mailing Lists

## 1. BACKGROUND

\*This research is partially sponsored by the FLOSSMetrics Project (Ref. No. FP6-IST5-033547), <http://flossmetrics.org/> and SQO-OSS project (Ref. No. FP6-IST-5-033331), <http://www.sqo-oss.eu/>

F/OSS developers are not bound to a single project. Even where they are contracted to work in corporate (eg JBoss), or foundation (Apache) projects, they still have the freedom to participate in other projects or communities of interest. They code, take part in discussions in various mailing lists and forums, and occasionally participate in agile-styled project's sprints. Along the way they leave a trail of experience, wealth of knowledge and skills associated with their art. This may be in the form of large and small bits of code, coding ethics and guidelines, documentations, etc. Participants in various F/OSS projects use tools (Versioning Systems (CVS/SVN), mailing lists, Bug tracking systems, etc.) to enable the distributed and collaborative software development process to proceed. These tools serve as repositories which can be data mined to understand *who* is involved, *who* is talking to *whom*, *what* is talked about, *how much* some one contributes in terms of code commits or email postings. Such information provides insights into the nature of collaboration in the projects concerned. Repositories of some F/OSS projects have extensively been used to better understand the contribution of developers [12, 6], trends and inequality in posting and replying activities in Apache and Mozilla [10], KDE [8], Debian developer and non-developer lists [15], FreeBSD [4], to mention a few. Empirical research in these areas is aided by the fact that F/OSS data is widely and freely available in various repositories in various formats [11, 7]. However, there are problems associated with aggregation and extraction of F/OSS data [2, 14]. A trend in F/OSS research is the use of data stored in a repository of repositories or *RoRs* (e.g. FLOSS-Mole and FLOSSMetrics)<sup>1</sup>, in which data from many and varied projects are brought under one umbrella so that researchers can have easy access [14]. One major advantage of RoRs is that they offer an aggregated mixture of meta-data in various formats, allowing researchers to concentrate more on there analysis than data scouting. This research benefits from such RoRs; the FM retrieval system ([http://fm3.libresoft.es/retrieval\\_system/](http://fm3.libresoft.es/retrieval_system/)) of the FLOSS-Metrics project.

<sup>1</sup><http://ossmole.sourceforge.net/> and <http://flossmetrics.org/>

F/OSS projects are different in their organizational structures as well as their unique way of doing things. However, certain aspects are fundamental to all projects. Source configuration management (SCM), of which CVS or SVN is a part, is a *de facto* tool used to coordinate and view the coding activities of software developers, manage software builds and releases, and other software development related activities. Mailing lists, on the other hand, are the main communication channels [15]. Many important aspects of a project are negotiated in developer lists: software configuration details, the way forward and how to deal with future requests, how tasks are distributed, issues concerning package dependencies, scheduling online and off-line meetings, etc. For a developer to keep abreast with developments in a project, committing code to SVN alone is not sufficient. S/he needs to participate in the respective lists, communicate his ideas, and engage with colleagues. However, due to the volunteering nature of F/OSS development [9], developers are free to choose what to work on, and where to contribute and channel their efforts. Thus, a comprehensive investigation of developers must not only concentrate on their code contribution but also revisit their activities in other project's media (e.g. developer mailing lists) and compare and contrast their quantitative and qualitative contributions.

### 1.1 The purpose of our research

F/OSS researchers study and report developers coding activities in CVS [10, 8, 4] or change logs [1] separately from their mailing lists activities. Important as these studies and their findings are, we conjecture that not all the developers who commit or make changes to a project's source repository also participate in developer mailing lists. In order to fill this gap in F/OSS research, this study investigates the concurrence or simultaneous occurrence of F/OSS developers in both SVN and developer mailing lists. That is, we find out if F/OSS developers are coding through commits in SVN as much as they are "talking" in developer mailing lists.

Our understanding of the F/OSS development process informs us that in many projects, a small number of talented core developers or "cod gods" are busily tinkering with code to produce good and usable software for the rest of the community. We also know the contribution these code gods make to discussions in mailing lists; they interact with other software developers and users, the keep abreast with project activities and monitor the what goes on in there projects. Little or no research has attempted to correlate developers commits activities with their corresponding mailing lists activities, either within the same project or across projects. Active mailing lists is a proxy of project success [5, 3]. However, involvement in mailing lists should not only be limited to non-developers. The presence of project's leads, core and active developers in mailing lists has a profound effect on the way individuals within and outside the project see the commitment of the most influential members in the project. For software companies and private enterprises, their presence in lists may indicate that software support activities are not only available from ordinary users, but also comes from individuals behind the software and project. This argument leads to the formulation of the following hypothesis:

*H0 (null):* FLOSS developers contribute equally to code

repository and mailing lists, with alternative:

*H1:* FLOSS developers contribute more to code repository than mailing lists.

In what follows, we investigate the hypothesis and draw conclusions. Our data comes from SVN commits and mailing lists archives of fourteen F/OSS projects from the FM retrieval system. First, in Section 2, we present the methodology used in this research, followed by an analysis of our preliminary results in Section 3. Implications of our findings, limitations, and work in progress concludes this paper in Section 4. The observations we have made so far may provide some salient issues to be discussed and fine-tuned with workshop participants.

## 2. RESEARCH METHODOLOGY

Our research methodology aims to overcome challenges associated with investigating the simultaneous occurrence of developers in SVN and mailing lists. This has to do with difficulty in (*identification*) making sure that the developer making SVN commits in a project is the same individual posting to the developer mailing list(s) of the same project. An outline of the methodology (figure 1) shows the FM re-

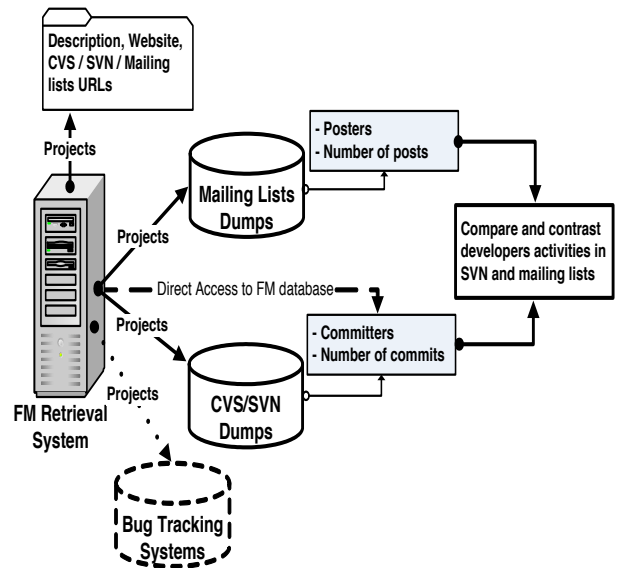


Figure 1: Outline of research methodology

trieval system as our data set choice. In addition to mailing lists and CVS/SVN data dumps, the system provides many attributes of a project including project's description and website, SCM and mailing lists urls. One important use of the SCM urls is to allow researchers to locally checkout and browse projects' repositories and view and analyze change log data. Researchers can freely download and use available SVN and mailing lists data dumps. Bug databases of FM projects are currently being processed. For a detailed specification, design, and description of the FM database, refer to the FLOSSMetrics project's work-package 3 deliverable (3.1, 3.2)<sup>2</sup>. Figure 2 shows three tables from the FM database that we used to obtain SVN and mailing lists data.

<sup>2</sup><http://flossmetrics.org/sections/deliverables/WP3>

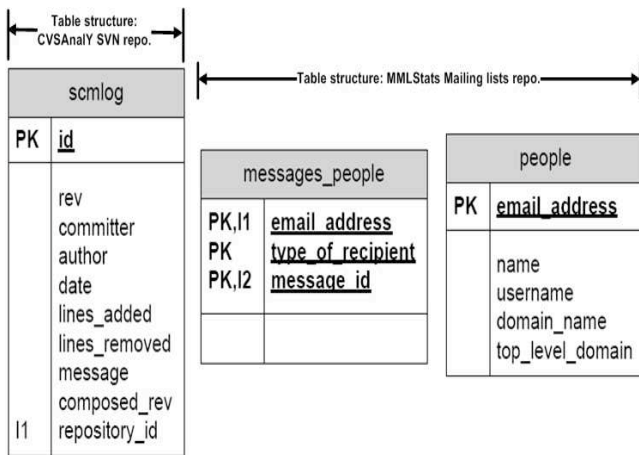


Figure 2: FM's SVN and Mailing list tables schema

As of 31st May, 2008, the FM beta version contained 60 projects with both analyzed data from source code management and from mailing lists repositories. From these we randomly selected 14 projects. Our choice of projects was guided by two selection criteria:

- projects should cover as many domains as possible, and
- developer contribution in terms of commits and postings should vary as much as possible.

With this criteria we hoped avoid selecting and studying only "successful" projects with large developer contribution and being bias towards one domain.

## 2.1 SVN Data

The CVSAnalY<sup>3</sup> database dumps provided by the FM retrieval system contains tables with SVN actions and information on committers. However, instead of downloading and using the SVN dumps, we used a python script to access the FM database, as a test and an alternative (see figure 1). Each project in the FM database can have one or more SVN dumps. For each project, we extracted the SVN committers and the number of commits they made. These two values act as fields in an mysql table (*commits*) for committer identification in each project (see figure 3). Table 1 shows descriptive statistics of the SVN data in the fourteen projects studied. For each project the total number of SVN

Table 1: Projects by Commits before analysis

Project	N <sub>c</sub>	Mean	Median	Std. Dev.	Skew.	Max. Com-mits	Total com-mits
activemq	13	153.54	23.00	287.974	2.085	854	1996
ant	62	349.19	95.50	607.249	2.821	2908	21650
apr	132	191.56	55.00	318.549	2.230	1277	25286
beehive	13	330.54	258.00	331.582	1.475	1015	4297
ekiga	3	1010.33	459.00	1295.219	1.568	2490	3031
felix	12	58.92	30.00	85.896	1.758	260	707
gdm	24	92.67	20.50	203.638	3.265	894	2224
gedit	18	77.78	4.50	154.890	2.564	587	1400
ibatis	5	170.40	157.00	172.575	1.504	458	852
libsoup	4	170.25	171.00	190.241	.000	335	681
nautilus	171	94.01	13.00	210.142	3.112	1202	16075
openejb	4	583.75	339.50	767.955	1.243	1647	2335
Spamassassin	14	1106.07	212.50	1278.926	.741	3120	15485
turbine	24	107.92	77.50	128.307	1.786	540	2590

committers (N<sub>c</sub>), the mean commit per committer, the to-

<sup>3</sup><http://cvsanaly.tigris.org/>

tal number of commits made by N<sub>c</sub> developers, and other relevant statistics, are shown.

## 2.2 Mailing Lists Data

The MLStats<sup>4</sup> database data dumps provided by the FM retrieval system contains one or more mailing lists archives of a particular project. Structurally, the data is a dump of the retrieval system's database ("*fm3.activemq-mls*"). We downloaded \*.sql files dumps of each project and extracted data contained in two tables:

- *messages\_people* table (**email\_address**, **type\_of\_recipient** ('From','To','Cc'),...), and
- *people* table (**email\_address**, **name**, **username**,...).

This information acts as fields in two mysql tables for mailing lists posters identification in each project (see figure 3). Table 2 shows, for each project, the total number of posters

Table 2: Projects by Posts before analysis

Project	N <sub>p</sub>	Mean	Median	Std. Dev.	Skew.	Max. Post	Total posts
activemq	1548	8.03	2.00	65.898	34.813	2487	12430
ant	7301	8.67	3.00	52.725	32.967	2704	63312
apr	1060	17.47	2.50	70.120	10.842	1433	18514
beehive	272	6.57	2.00	16.970	5.874	152	1787
ekiga	525	7.93	2.00	47.647	19.774	1040	4163
felix	319	21.52	3.00	102.587	10.947	1283	6866
gdm	640	3.56	1.00	21.666	18.982	484	2281
gedit	471	4.11	1.00	15.543	12.085	266	1935
ibatis	1406	9.13	3.00	40.500	15.507	784	12830
libsoup	26	6.23	2.50	8.262	2.672	37	162
nautilus	2091	16.81	4.00	117.340	32.373	4719	35150
openejb	77	13.88	4.00	34.549	5.897	271	1069
spamassassin	4658	28.91	6.00	148.806	16.883	4248	134649
turbine	1874	21.01	6.00	70.111	10.700	1182	39377

(N<sub>p</sub>), the mean post per poster, the total number of posts made to the project's mailing list by N<sub>p</sub> developers, and other relevant statistics, are shown.

## 2.3 Identifying Developers

In CVS or SVN and change logs, an individual is simply identified as a "Committer" or an "Author" of one or more commits. Mailing lists participants, on the other hand, can be identified by means of message identifiers like "From:" in email headers [13].

After extracting data of SVN committers and mailing lists posters, we proceeded with identifying developers as shown in figure 3.

We queried the three tables to obtain data for our analysis. With this method, we were able have fairly accurate identity of individuals and their SVN and mailing lists contribution.

## 3. INITIAL RESULTS & ANALYSIS

Table 3 shows the number of developers (N) who made SVN commits and posted information to the project's mailing lists. Comparing tables 3 and 1, in eight out of the fourteen (57.14%) projects studied, all the SVN committers also participated in mailing lists discussion. In four projects over 90% and in two projects over 80% of the committers participated in lists. As shown by the sum of commits and posts in tables 3, developers in each project, with the exception of the *ibatis* and *turbine* projects, made more commits than posts. The mean commit per developer in each project, with

<sup>4</sup>[http://tools.libresoft.es/mailling\\_list\\_stats](http://tools.libresoft.es/mailling_list_stats)

Table 3: Statistics on Developers who made both commits and posts

Project	Commits						Posts					
	N	Sum	Maximum	Mean	Median	Std. Deviation	N	Sum	Maximum	Mean	Median	Std. Deviation
activemq	13	1996	854	153.54	23.00	287.974	13	807	380	62.08	5.00	109.439
ant	62	21850	2908	349.19	95.50	607.249	62	10026	2704	161.71	21.00	422.599
apr	129	24857	1277	192.69	56.00	320.824	129	11319	1433	87.74	22.00	173.654
beehive	12	3282	1015	273.50	239.50	271.666	12	202	104	16.83	6.50	28.565
ekiga	3	3031	2490	1010.33	459.00	1295.219	3	1228	1040	409.33	184.00	553.539
felix	12	707	260	58.92	30.00	85.896	12	457	223	38.08	15.50	61.745
gdm	20	2063	894	103.15	16.00	222.023	20	467	227	23.35	2.00	53.664
gedit	17	1399	587	82.29	5.00	158.431	17	334	266	19.65	2.00	63.659
ibatis	4	695	458	173.75	114.50	199.085	4	750	740	187.50	4.50	368.343
libsoup	4	681	335	170.25	171.00	190.241	4	68	37	17.00	13.50	15.684
nautilus	168	15968	1202	95.05	13.00	211.803	168	12891	4719	76.73	10.00	384.816
openejb	4	2335	1647	583.75	339.50	767.955	4	84	74	21.00	4.00	35.384
spmassassin	14	15485	3120	1106.07	212.50	1278.926	14	7235	2834	516.79	23.00	960.613
turbine	24	2590	540	107.92	77.50	128.307	24	15390	2364	641.25	224.00	825.384
<b>Total</b>	<b>486</b>	<b>96739</b>	<b>3120</b>	<b>199.05</b>	<b>29.50</b>	<b>434.670</b>	<b>486</b>	<b>61258</b>	<b>4719</b>	<b>126.05</b>	<b>14.00</b>	<b>402.856</b>

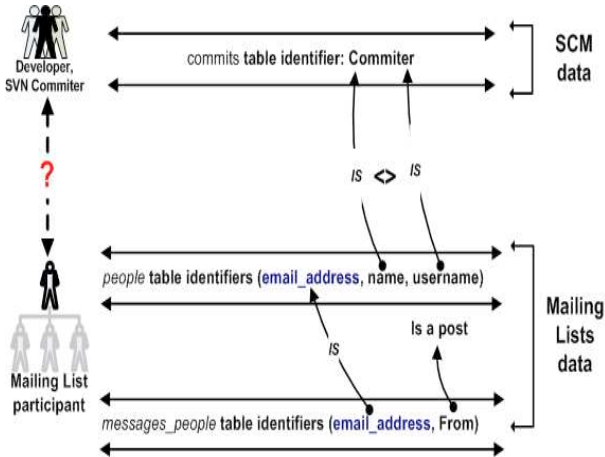


Figure 3: Identifying developers from multiple repositories (CVS and Mailing Lists)

the exception of the *turbine* project, are also greater than the mean post per developer.

### 3.1 Distribution of Commits and Posts

The box plots in figure 4 show the distributions of commits and posts for every project. The domination of commits over posts is evident in most of the projects. A comparison

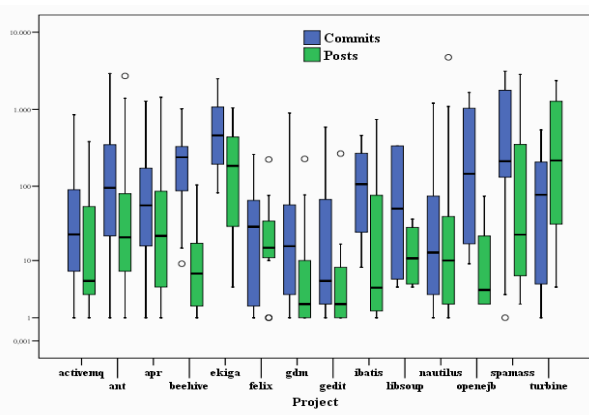


Figure 4: Distributions of commits and posts for every project. Y-axis in a logarithmic scale

of the distributions of commits and posts for all develop-

ers together is shown in Figure 5. The domination of SVN commits, with larger means of commit per developer, over mailing lists posts is evident.

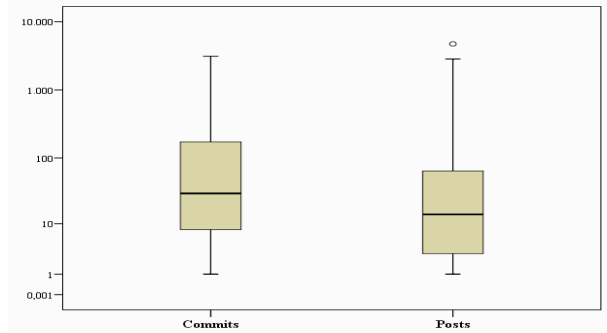


Figure 5: Distributions of commits and posts for all developers. Y-axis in a logarithmic scale

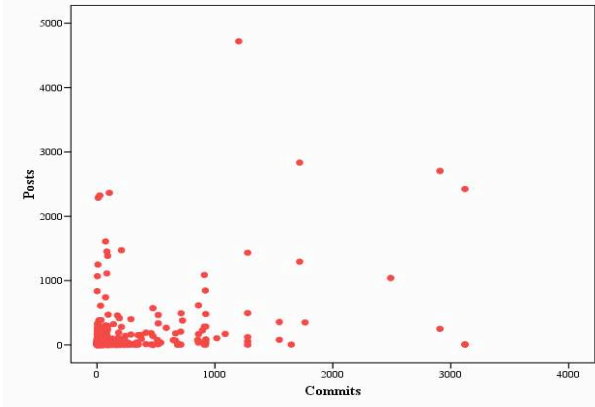
### 3.2 Relationship Between Commits and Posts

We used correlation between commits and posts to study how developers activities in SVN and mailing lists are related. The scatter plots in figure 6 shows the correlation between Commits and Posts in all projects, in two different scaling dimensions.

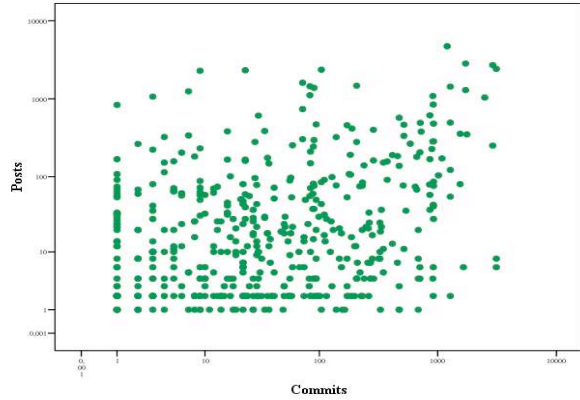
Since the distributions of both variables (commits and posts) are highly skewed and different from normal (kurtosis commits=20.150, std. dev.=434.670; kurtosis posts=47.720, std. dev.=402.856), we use the nonparametric coefficient of Spearman which is based on ranks. For each project separately and for all projects together, table 4 gives the Spearman's coefficient ( $\rho$ ) and their significance ( $p$ -value). Note that the significance is dependent on the size of the sample. Projects showing statistical significance ( $p < 0.05$ ) are marked with an asterisk(\*).

### 3.3 Developers Contribution

In order to measure how much developers contributed in terms of commits and posts, we tested the difference between commits and posts for each project and for all the fourteen projects together. We use the Wilcoxon signed rank test for two related samples. For each project separately, and for all projects together, table 5 shows the significance ( $p$ -value) of the test. Statistically significant differences are



(a) for all projects in linear scale



(b) for all projects in logarithmic scale

Figure 6: Correlations between commits and posts

Table 4: Commits-Posts Correlation measures

Project	N	Spearman's $\rho$	Significance (p-value)
activemq	13	0.612*	0.026
ant	62	0.294*	0.020
apr	129	0.283*	0.001
beehive	12	0.317	0.315
ekiga	3	1.000*	0.000
felix	12	0.173	0.591
gdm	20	0.350	0.130
gedit	17	0.528*	0.029
ibatis	4	0.000	1.000
libsoup	4	0.949	0.051
nautilus	168	0.123	0.113
openejb	4	0.738	0.262
spamassassin	14	0.171	0.559
turbine	24	-0.197	0.357
All projects Together	486	0.266*	0.000

considered those having  $p < 0.05$ . In case of significant difference, from the mean ranks we can understand whether commits are generally more than posts. This is denoted by "commits > posts", otherwise we write "commits < posts". In projects where there is no statistical difference ( $p > 0.05$ ) we write "commits = posts".

Table 5: Difference in developers' contributions

Project	N	Significance (p-value)	Type of difference
activemq	13	0.124	commits = posts
ant	62	0.000	commits > posts
apr	129	0.000	commits > posts
beehive	12	0.002	commits > posts
ekiga	3	0.109	commits = posts
felix	12	0.424	commits = posts
gdm	20	0.006	commits > posts
gedit	17	0.007	commits > posts
ibatis	4	0.715	commits = posts
libsoup	4	0.109	commits = posts
nautilus	168	0.086	commits = posts
openejb	4	0.068	commits = posts
spamassassin	14	0.035	commits > posts
turbine	24	0.012	commits < posts
All projects Together	486	0.000	commits > posts

#### 4. DISCUSSION AND CONCLUSIONS

In this paper we have investigated whether F/OSS developers are committing more to SVN than they are posting to mailing lists. This involves tracking their activities in two or multiple repositories and studying their quantitative contribution. This kind of research is made difficult because of the problem associated with the identification of developers in both repositories. The FM retrieval system's table schema has fields attributes which enabled us to overcome this research obstacle so that we are able to study the simultaneous occurrence of developers and measure their contributions in multiple repositories (SVN and mailing lists). The methodology presented in this paper is a possible means to leverage problems associated with empirical F/OSS research in this area.

The conclusion of our research supports our hypothesis.  $H_0$  (null), FLOSS developers contribute equally to code repository and mailing lists. The null hypothesis is that the number of commits and the number of posts have the same distribution ( $\rho = 0.000$  for all the 486 committers who are also posters in the fourteen projects). Alternatively ( $H_1$ ), FLOSS developers contribute more to code repositories than mailing lists. The distributions of the two variables (commits and posts) are different for each project (with commits dominating) as shown by the various plots (see figures 4- 6). Furthermore, looking closer at the cases where the difference is not significant, we can see that the number of commits is greater. For example, the *nautilus* project has  $p = 0.086$  providing some evidence of difference at the 0.10 level and, domination of commits. The only exception was observed in two projects (*turbine* and *ibatis*), where the number of posts are greater than the number of commits. One explanation for this deviation could be that in both projects the prolific committer who is also the most prolific poster had exceptionally high commits (540 commits for the turbine project and 458 commits for the ibatis project) and posts (2364 posts for the turbine project and 740 posts for the ibatis project) relative to the rest of the community. But while the contribution of these prolific developers might skew the commits and posts in the projects, there could be other explanations. For example, both (*ibatis*, *turbine*) are Apache projects. Perhaps there is an underlying cause due to the structure or nature of Apache projects?

However, a number of factors or questions remains unanswered in this conclusion that we have not yet investigated. For example: **At commit level:** - What *kinds* of commits are the developers making? are they modifications, dele-

tions, additions? - What *types* of commits are the developers making? are the commits source code related, documents? - Time-stamp, when did a developer make those commits? **At mailing lists level:** - Is there a way we can consider postings to developers lists only from the FM mailing lists dumps? - What category of information are the developers posting? - What about 'replies'? are there developers who are just posting project or software package information without replying to postings others made to the lists? Answers to some of these questions may help us to have a qualitative insight into the developers contribution to both repositories. And support observations we have made so far.

#### 4.1 Few things we want to do

Since we have studied only those developers who are in both repositories, there is a tendency that we have missed some high prolific committers who may play a vital role in the project. We intend to look at other contributors with substantial commits and find out why they have no postings in their project's developer list(s). In our methodology, manual scan was necessary to remove some duplicates. The results of our SQL query sometimes yields results which require manual intervention. We are investigating how this methodology can be automated, perhaps by extending the functionality of CVSAnaY and MLStats data extraction and analysis tools.

#### 4.2 Ongoing & future work

1. As the FM retrieval system database continues to grow, we are extracting data from a number of projects which have SVN and mailing lists dumps available to further investigate the trends we have observed.
2. Using information available at the FM retrieval system we can extend the analysis of developers participation in multiple repositories by including data from each project's change log. We have observed that the top "commits by author" in the change logs of each of the projects studied happens to be in top committers and posters in our data.

### 5. ACKNOWLEDGMENTS

We wish to extend sincere gratitude to all FLOSSMetrics and SQO\_OSS partners who offered valuable comments and suggestions. In particular; Santiago Dueñas(FLOSSMetrics), Georgios Gousios(sqo-oss), etc.

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