



# Free/Libre and Open Source Software Metrics

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**Title: Industrial Inputs for Exploitation of FLOSSMetrics Results**

**Executive Summary:**

This document explores some of the possibilities of exploitation of the results of the FLOSSmetrics project for industrial use. For this, two specific case studies have identified, along with the related requirements on what would be most interesting results. The document describes the case studies, and the three most important goals: benchmarking, measuring own performance and selection of external open source for use.


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## 1. INTRODUCTION

### 1.1 MOTIVATION


This document describes the industrial exploitation options of the FLOSSMetrics results. The exploitation is partially based on two cases that are related to the Philips Healthcare work within FLOSSMetrics. One of these cases deals with an open source project, initiated and managed by Philips Healthcare, DVTk. The other is the internal use of open source methods in internal development: “inner source”. Both cases are also used as a case study in the ITEA project IF04031, COSI, where the business, process and architectural aspects of these cases are studied. For FLOSSMetrics, we investigate the use of process metrics, especially those that originate from FLOSSMetrics itself. In addition to the scenarios for which the cases have been selected, there are certain exploitation options that do not relate to those scenarios. These are connected to the options of using external open source software in the products or development environment of Philips Healthcare.

The cases and scenarios have also been complemented with information coming from other sources: companies such as SIG or Sun France, public administrations such as the OSOR project (IDABC, European Commission), and competence centers on FLOSS, such as the Morfeo-Qualipso Competence Center and CESJE.

One of the intermediate results of the COSI projects is that there are three fundamentally different reasons to have an interest in open source in a company:

- **Developing with OSS practices** – Development practices used by OSS communities are used by companies. The motivation to do so is (1) to achieve the same level of quality as the success stories of OSS, or (2) to manage distributed software development the same way as OSS communities do. This is done by observing and learning from OSS practices.
- **Development with OSS products** – Companies are using OSS products in their development activities. The companies using this approach need practices and processes to (1) select open source software tools that are suitable for their development projects, (2) to manage a platform of OSS to build products on, and (3) to involve in and influence open source communities to provide usable OSS.
- **Developing OSS products** – Many companies are interested in exploring the possibility of releasing their own software products as OSS products. Companies planning to do so are interested in processes for (1) releasing their products and (2) to manage the relationship with the community.

Each of the different ways lead to other ways to exploit FLOSSMetrics results. The Philips case studies reflect the first and last way of using open source. However exploitation of FLOSSMetrics in the case that a company develops using open source products will also be discussed. Philips is involved in the open source community of subversion, to be able to influence

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the next generation of tooling to be suitable for our own development. Some of the other inputs refer also to some of these categories.

## 1.2 OBJECTIVES


The aim of this document is to:

- describe the options of exploiting FLOSSMetrics results in industry
- set a basis for the case studies in Philips Healthcare executed within FLOSSMetrics
- set a basis for case studies to be executed with other institutions

## 1.3 STRUCTURE OF THE DELIVERABLE

The structure of this deliverable is as follows:

- The document starts with a description of the department Philips Healthcare, that is involved in the case studies
- Next follows a short description of the case studies themselves
- Next follows a description of the several exploitation options
- Next follows a description of the inputs and case studies to be executed with other institutions
- The document ends with some conclusions and description of next steps

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## 2. PHILIPS HEALTHCARE DEPARTMENT


Philips Healthcare (PH) is a division of Royal Philips Electronics N.V. By itself, PH is a multinational company. The international headquarters of PH are located in Andover (USA) and Best (near Eindhoven, the Netherlands), where the main development and production centres are located for many of its key system families. Philips Healthcare has long provided the tools necessary to stay ahead of the healthcare curve, from creating the first x-ray tube in 1896 to launching a dedicated Healthcare Services group in 1998. With its emphasis on capturing the images and information necessary to meet an individual's unique healthcare needs, Philips Healthcare is well positioned to help make the future of healthcare a reality.

Philips Healthcare delivers one of the world's most robust portfolios of medical systems for faster and more accurate diagnosis and treatment. Philips' product line includes best-in-class technologies in X-ray, ultrasound, magnetic resonance, computed tomography, nuclear medicine, PET, radiation oncology systems, patient monitoring, information management and resuscitation products, as well as a range of services which include asset management, training and education, business consultancy, financial services and e-care business services.

The company is distributed over the world, with product development in several countries. Product groups (divisions) are responsible for specific market segments. Typically, several (marketed) product lines are available in each product group. Although the different product lines differ a lot, there are also possibilities for software reuse. All deal with storing, retrieving, and exchanging medical images, and many product lines support image processing and viewing.

In 1997, an initiative was started to produce the common software for all the product lines as an imaging platform to be used across PH. During the introduction, several acquisitions have taken place increasing the portfolio of both modalities and non-modalities to come to a complete range of imaging products for hospitals. There is a strong drive from the management board to increase the synergy between the newly acquired and the original groups, and to reduce the total development costs. The imaging platform is a means to support this. The platform must be usable for all product groups.

In 2001 the first version of the platform was released, and implemented by the first product lines. After that, the number of product lines that use the platform have increased rapidly. The platform has since grown to cover many core medical software components. The company delivers a product line involving wide range of medical imaging products to its customers (hospitals in general) in various modalities [1], ch. 15. The domain engineering group provides a platform consisting of a collection of reusable and configurable components, based on a common architecture. The case studies in FLOSSMetrics are executed in the department delivering the platform for the whole of PH.

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### 3. CASE STUDIES


#### 3.1 DICOM VALIDATION TOOLSET

The Digital Imaging and Communications in Medicine Standard (DICOM, <http://medical.nema.org/>) enables companies in the medical domain to exchange medical images. Around 1995, the support of DICOM was an added value for medical equipment companies; interoperability was an add-on. Every company in the field made its own implementations. Around 2000 the clients just expected DICOM support; without it the product will not be sold. Because interoperability is important for the clients (hospitals), it is of value for everybody to exchange images with any equipment from any company. As a consequence, in 2001 a decision was made by Philips and Agfa to make a reference implementation of a DICOM standard validation toolkit (DVTk) available as free binary, to be shared with the competition. However, at that time, the development of the toolkit was still proprietary development. Later, in 2005, when the validation toolkit in itself no longer provided any added value to the products, it was decided to release the source into the open (<http://www.dvtk.org/>). This enables sharing development and maintenance on a much wider scale. The goal is to create world-wide acceptance of DVTk as a independent (de-facto standard) tool. This is of value for both Philips and the competition. DVTk was awarded as most promising open source project in the radiographic domain of 2005 by the RSNA (Radiology Society of North America).

#### 3.2 INNER SOURCE

*Inner source* is a way to exploit the advantages of distributed development in the open source way, but with a wish to avoid problems with planning, ownership and control [2,3,4]. Several companies have adopted to an inner source development model. In inner source development a set of teams collaborate in a cooperative eco-system. Similar to open source development, inner source development applies an open, concurrent, model of collaboration. It implies distributed ownership and control of code, early and frequent releasing, and many continuous feedback channels. It makes use of organisation mechanisms already in place, e.g. for escalation of conflicts or setting up roadmaps. Inner source enables flexibility in (starting, stopping, and changing of) collaborations, in timing and setting priorities of development teams across organisational (and geographical) boundaries. Companies can use inner source development as an intermediate step towards the integration of open source in their products.

Philips Healthcare has introduced inner source for its platform development. The platform development group faced the problem that they may become a bottleneck to the many application developing groups. The domain releases are planned in a process with many stakeholders, so the resulting release schedule did not satisfy the planning of certain application engineering groups. Market dynamics can force product groups to change their planning, but the domain planning process lacks flexibility to adapt to these changes.

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The inner source development is based on elements of open source development. It decouples application engineering from the domain engineering, as each application engineering group can decide themselves whether they:

- *Use as is:* they wait for the next release of the platform
- *Contribute through patches:* take an earlier version of a component and optionally patch it
- *Work together as virtual team:* take responsibility for the development of some, for those group crucial, domain components.

To support these various ways of working a web-based collaborative development environment was introduced (CollabNet - <http://www.collab.net/>).

The main inner source development principles are to have easy access to all information of the product line. As in open source development the policy is to release early and often, in order to enable fast information flow from domain to application As well as having a distributed ownership and control of all domain assets. The domain team owns and develops domain components. An application developer is allowed to change components, and is responsible for the change. The change may be offered back to the domain team. The platform team can accept the patch into the platform, taking over ownership.

As a consequence of this, the involvement of the application teams in the domain is improved. This has as side effect that the platform is more widely adopted than previously, and it better suits the needs of the application groups. Inner source enabled new product launches since 2005. It led to a time to market reduction of at least 3 months.

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## 4. EXPLOITATION OPTIONS

There are three main areas for the exploitation of the results of FLOSSMetrics by the industry:

- *Benchmarking* to compare own development with open source developments
- *Measuring* to get feedback on performance of own developments
- *Selecting mechanism to select* open source for use within the company

The next section gives more details on how these goals can be achieved with the FLOSSMetrics results.

### 4.1 BENCHMARKING TO COMPARE OWN DEVELOPMENT WITH OPEN SOURCE DEVELOPMENTS


For benchmarking, it is important to select projects in the open source world on similar topics, and see how they behave. For our inner source development it is important to know whether it is comparable to open source development, and where the differences are. A next step is to investigate the differences. This may lead to decision on whether we adapt, or keep the difference as an important aspect of our own development.

For our DVTK toolkit, and others, it is important to compare with similar projects. This enables PH to better evaluate the way the project is behaving, and possibly where it is in the life cycle. It provides information to answer questions like: “does the project need corrective actions, or is it on the right track?”, “are there practices in other open source projects that may be beneficial for our own developments?”

Benchmarking in the case of development with OSS products is useful to select the communities whose development practices are similar to those in companies. Both in the case of inner source development and of opening own software the development is shifted towards open source practices. However, there are always aspects in the development that are either well adapted, or less suitable within the own development environment.

**Case study:** The specific case study in this area will be a benchmarking study for DVTK. Several (5-10) projects with similar characteristics to DVTK will be selected, and a comparative study of the corresponding production patterns will be performed. The selection will be made according to the main product and development parameters, such as total size (in SLOC) and development history (time since first commit, initial core team, initial activity, etc.). The study will try to uncover the similarities and differences, according to the main issues identified in the previous text.

If possible, this study will also be performed for other, inner-source, project. For it, only general parameters will be provided by PH, which should allow for the identification of the

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benchmarking projects, which will be studied, with results being provided to PH. This second case is subject to proper identification by PH of a suitable case.

#### 4.2 MEASURING TO GET FEEDBACK ON PERFORMANCE OF OWN DEVELOPMENTS

The DVTK project uses tools similar as to those used within open source communities. However, because of business reasons, the tooling is partly according to company rules, and partly the maintenance of the collaboration tools is outsourced to Collab.net. This means that the environment is not completely compatible with the FLOSSMetrics tooling (although it is close to that). The most relevant missing capabilities are:


- Repository and mailing lists on Collab.net. They are not available in mbox format, which is the only one that current FLOSSMetrics tools can process.
- C# coding. For C#, the only metrics that the FLOSSMetrics tools can calculate is SLOC. However, the whole set of metrics on the commit patterns in the Subversion repository can be calculated.
- Collab.net bug tracking. Current FLOSSMetrics tools cannot access Collab.net. In fact, that information is not currently public, which means it is not suitable for FLOSSMetrics.

Fortunately, these shortcomings do not affect the most interesting aspect, which is the measurement of the development itself. An important issue is to know who does what, and where the hot spots in development are. This is necessary to track expertise and coverage of the subject that need development. In addition it enables the identification of groups with similar interest, and determining the balance between contributions from the core and remote groups, as well as give an indication for to what extent self-organization works. Especially in this case it is important to know how much action there is outside the core team and what is the balance between business paid contributions and free-time contributions. The core team is still mainly the original people who developed the tool kit before it went open. It is important to know how much maintenance is now shared with the community.


**Case study:** A detailed study of the development of DVTK will be performed, with the aim to answer the main questions posed above. In particular, territoriality (who is contributing to which parts of the code) and generations (how are core teams contributing over time) studies will be performed. Also, identification of activity by specific developers, and areas of the software with more development activity will be performed. The results will be discussed with PH experts.

#### 4.3 SELECTING MECHANISM TO SELECT OPEN SOURCE FOR USE WITHIN THE COMPANY

For in-house development with OSS products, it is necessary to find projects in the open source world that provide the right tooling. If the company wants to become involved, it is relevant to know in advance certain process parameters, to be sure that the products of those projects can be accommodated to our own environment.

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No specific case study has been identified for this, but the final database is expected to provide a lot of information on open source developments. Especially for our own tooling environment we would like to know what the best candidates are for external tooling. The database gives information whether the development is healthy, so that we can trust the continuation of the maintenance. It may lead to a top list of OSS projects that are interesting for us, and whether we should invest in connecting and interacting with them. In particular, the parameters mentioned in deliverable D4.1 seem to fulfil PH needs in this respect. Although no specific case study will be performed, informal check of the suitability of those parameters will be performed.

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## 5. INPUTS AND CASE STUDIES WITH OTHER INSTITUTIONS

To complement the inputs and case studies provided by PMS, a FLOSSMetrics partner, several contacts with other companies and institutions, external to the FLOSSMetrics consortium, have been conducted, in some cases leading to specific case studies. These contacts have been conducted only partially with resources of the FLOSSMetrics project.

### 5.1 SOFTWARE IMPROVEMENT GROUP (SIG)


Software Improvement Group<sup>1</sup> (SIG) is a Dutch company which provides insight and analysis into the quality of software systems. They perform studies on the software systems developed by their clients or for their clients, and recommend how to improve them.

The relationship between SIG and FLOSSMetrics have been short, since it started when the project was in its closing phase. However, several areas of interest were identified, and some case studies on the use of FLOSSMetrics data and platform are being carried on by SIG itself.

The specific areas of interest identified by SIG are in the FLOSS development and generic software development domain. Some of these areas are:

- Availability of a large quantity of information about FLOSS development. SIG had started its own efforts to collect development information about FLOSS projects, and quickly appreciated the vast amount of data that was already available from the FLOSSMetrics projects. Some members of the FLOSSMetrics project have worked with SIG staff to let them understand how to benefit from these data, and how to find the information they need.
- Engineering of the retrieval and analysis of information from software repositories in a large scale. SIG has also found interesting the insight that FLOSSMetrics tools and reports have provided them in the area of data retrieval from software repositories, and in particular, public repositories in a large scale, as is the case of the FLOSSMetrics platform. The interactions with the FLOSSMetrics project have been helpful in stimulating their research on project metrics for commercial software projects.
- Visualization and understanding of large quantities of data about software development. Partly due to the interactions with the FLOSSMetrics team, SIG has come into the position where they are able to visualize and quantify project data in a meaningful way.
- Correlation of different kinds of metrics. SIG has also been able to achieve preliminary results on the correlation of product and project metrics. Their first experiments indicate that

<sup>1</sup><http://sig.nl>

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the product ratings of the TÜViT/SIG software product quality model are positively rank-correlated with aggregated scores for defect solution throughput time. They are looking forward to broadening these experiments, with the idea that their empirical results will constitute a break-through in the area of software quality.

## 5.2 OPEN SOURCE OBSERVATORY AND REPOSITORY (OSOR)

The OSOR<sup>2</sup>, Open Source Observatory and Repository for European public administrations, is a platform for exchanging information, experiences and FLOSS-based code for use in public administrations. It is an initiative of the IDABC program, funded by the European Commission, and is supported by European governments at national, regional and local level.

One of the services of OSOR is the hosting of a FLOSS forge, specialised in FLOSS for public administrations. The forge is aimed to host development projects of potential interest for European public administrations, and as such is interested not only in the infrastructure supporting the development, but also on having services characterising and describing how the resulting products, and its software development process, perform.


FLOSSMetrics participants have discussed with the OSOR maintenance team about how to improve the data offered both to developers and to potential uses of products developed at the OSOR forge, and how the FLOSSMetrics infrastructure and tools could benefit OSOR users. As a result of this discussion, some results have been or are being implemented:

- OSOR has included visualization tools partially developed for FLOSSMetrics. After adaptation to the OSOR needs, some data collection tools and glue software developed for FLOSSMetrics have been integrated with the OSOR forge. In particular, the “Metrics” tab found in projects in the OSOR forge<sup>3</sup> is implemented in part with some of the tools developed and integrated by the FLOSSMetrics project.
- Some OSOR projects have been identified as case studies for FLOSSMetrics, leading to some ongoing studies on exploitation of FLOSSMetrics results.

Further collaborations with OSOR are envisioned for the next months. In addition, this is expected to be a first step towards improved collaboration with other European forges for public administrations, which hopefully will lead to more experience on how the FLOSSMetrics infrastructure and data can be exploited in that domain.

<sup>2</sup><http://osor.eu>

<sup>3</sup>See for instance <http://forge.osor.eu/plugins/metrics/index.php?id=13&type=g>

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### 5.3 MORFEO-QUALIPSO COMPETENCE CENTER (MORFEO CC)

The Morfeo-Qualipso Competence Center on FLOSS<sup>4</sup> (Morfeo CC) is one of the Competence Centers in the Qualipso Network. Created by Telefonica, Universidad Rey Juan Carlos and Universidad Politecnica de Madrid, it is a joint initiative with the Morfeo community, a network of large companies, SMEs, research and technology centres, and public administrations interested in using FLOSS to develop business opportunities and transfer research results to the industry.

One of the activities of the Morfeo CC is the maintenance of the forge of the Morfeo Community. Therefore, many opportunities for exploiting FLOSSMetrics results have appeared in this area. In addition, the Morfeo CC is also providing consultancy services, some of which include advising about FLOSS and FLOSS development. For these activities, collaboration between the Morfeo CC and FLOSSMetrics has started in two areas, both providing inputs to the exploitation of results:

- *Inclusion of FLOSSMetrics tools and infrastructure in the Morfeo forge.* Current conversations with the Morfeo board and the technical board of the Morfeo CC are oriented to include in the Morfeo forge facilities similar to those already mentioned for the OSOR. The Morfeo community is providing valuable information with respect to their needs and interests in this area. This feedback will help to refine how FLOSSMetrics presents its data to third parties.
- *Use of FLOSSMetrics data for Morfeo CC consultancy services.* Although the Morfeo CC, being a member of the Qualipso network, is expected to use the methodologies and results of the Qualipso project, it can also use other tools and techniques in its areas of competence. In this case, the Morfeo CC is already discussing with FLOSSMetrics how to use some of the data the project is providing to advise about improvements on FLOSS development and FLOSS use. In part, the lines of work are based on the FLOSSMetrics Guide for SMEs.


In the near future, these lines are expected to conclude in some case studies that will use FLOSSMetrics data, and maybe in the use of FLOSSMetrics as the preferred metrics source for the Morfeo forge and Morfeo CC.

### 5.4 OTHER INSTITUTIONS

Some other institutions have shown interest in the results by FLOSSMetrics, and are already providing some input for exploitation:


- **Sun France.** Some representatives of Sun France have expressed interest in using FLOSSMetrics infrastructure to analyse projects in their own forge for the Java community. In particular, some projects in which they work could be analysed using FLOSSMetrics in the near future.

<sup>4</sup><http://cc.morfeo-project.org/lng/en>

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- **Centro de Excelencia Software Libre José de Espronceda (CESJE).** CESJE (located in Extremadura, Spain) is a Competence Centre on FLOSS aimed to promote FLOSS usage an development in Extremadura (Spain), in particular among SMEs. The FLOSSMetrics project has already had some preliminary conversations with CESJE representatives about the use of FLOSSMetrics data, according to the procedures mentioned in the FLOSSMetrics SME Guide, to assess on FLOSS usage to SMEs and other insitutions in their area of competence.
- **Plone and Zope communities.** Plone and Zope communities, via ZEA (partner in FLOSSMetrics) are providing feedback suitable as exploitation input about how they can use and area already using FLOSSMetrics data for their own needs. In this respect, one of the most interesting inputs has been the traceability of the data provided by FLOSSMetrics, when compared to the closeness of the data provided by other providers in this area. The interest of the FLOSSmetrics project goes beyond the data itself. The close interaction with Universities and experts involved in the project enabled Zea network and its members SME enabled to develop a long term relationship with experts and a better understanding on how to interpret the data extracted from the community source code, which in turn may open the way on improving community development and management practices.


Contacts with other companies and groups have been established, and are in the process of providing yet more inputs on exploitation. These include OW2 Foundation, GNOME Foundation, Apache Foundation, BBVA, CENATIC Foundation (Spanish Public Foundation), Antelink (French SME) and others.

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## 6. CONCLUSIONS AND NEXT STEPS

This deliverable gives an overview of the main results within the FLOSSMetrics project for industrial use. We have focused on the main topics that are of interest, benchmarking, measuring own development and ability to assess open source projects for their use. We have related these objectives to the main objectives of our own development.

Next steps are to perform the specified studies (presented in section 4). Their results will be presented in deliverable 9.2.

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## 7. LITERATURE

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