Title	[博士論文計画調査報告書] FLOSS における組織構造と不具合混入の因果関係分析
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Abstract

The social importance of Free/Libre and Open Source Software (FLOSS) is increasing, as about 70% of commercial applications are built of FLOSS. However, serious security incidents, such as Heartbleed of OpenSSL, have occurred. Heartbleed is a vulnerability discovered in OpenSSL Ver. 1.0.1 of the OpenSSL cryptographic library on April 01, 2014, and is assigned the Common Vulnerability Identifier Identification Number CVE-2014-0160. The Heartbleed affected about 500,000 web servers around the world and caused extensive damage. Later investigations revealed that OpenSSL was developed and maintained by only three developers, although it is the most important software supporting cryptographic communications worldwide. As a result, Heartbleed was left open for about 822 days from the time the bug was introduced on December 31, 2011, until it was discovered on March 14, 2012, and developed into a serious security incident that had an enormous impact on society as a whole. There are many FLOSSes, like OpenSSL, that, despite their social importance, do not have sufficient developers or funding to support them. As a result, serious bugs are left unattended and develop into serious security incidents that affect the whole society. Thus, the burden on FLOSS developers increases due to the general public's perception that "FLOSS" is free, even though it is an important software. Therefore, it is necessary to create an ecosystem in which sufficient human and economic resources are available for important FLOSS. The purpose of this study is to accurately understand the problems facing the FLOSS, their causes, issues to be addressed, and measures being taken to achieve the ecosystem.

FLOSS is an umbrella term that encompasses both free software and open source. There are two definitions of free software: The Free Software Definition by the Free Software Foundation and The Debian Free Software Guidelines by the Debian Project. There is the Open Source Definition by the Open Source Initiative as a definition of open source software. FLOSS includes many different types of software, such as web servers, web browsers, operating systems, security, databases, frameworks, programming languages, virtualization/cloud, etc. Participants in FLOSS include "engineers and end users" and "committees and contributors". In recent years, companies that use FLOSS for profit, non-profit organizations that support the development of FLOSS, and full-time engineers that develop FLOSS while belonging to these organizations have emerged.

For this reason, we surveyed and analyzed the existing research on FLOSS. Firstly, metadata such as titles and abstracts were extracted from 508 scientific papers on FLOSS and stored in a database. Secondly, we identified the problems that have attracted attention such as (1) longer defect correction times, (2) poor sustainability, and (3) higher development costs from the existing survey papers and FLOSS use case reports. Next, we subdivided the problems (1) - (3) into subproblems and categorized the causes of each sub-problem, the issues that hinder them, and the measures taken to address them, to get a bird's eye view of FLOSS. Finally, we analyzed the existing research on FLOSS based on "quality based on source code and organizational structure" and "micro and macro perspectives". The results show that research focusing on organizational structure from a macro perspective is important for understanding the quality of FLOSS, but not enough research has been done.

We also surveyed existing research on organizational structure analysis methods and, as a preliminary experiment, analyzed the FLOSS project from the perspective of developer behavior and communication. The results showed that there was a risk of stagnation of FLOSS development when a developer with a large amount of activity left the FLOSS project.