



Master's thesis

Master's Programme in Computer Science

# **Public Licenses in Software Engineering: A Multivocal Literature Review**

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| <p><b>Context:</b> Public software licenses are central to the distribution of works in software engineering. For example in open source there must be an appropriate public software license attached to the source code in order for open-source software to be freely available for possible modification and redistribution. The large number of these public software licenses is one contributing factor in the difficulty of understanding how these licenses work.</p> <p><b>Methods:</b> As the goal is to explore and evaluate different public licenses in software engineering, whilst also taking a look into the different sites listing these public software licenses, this study adopts a systematic literature review approach. The search strings, search process and other relevant information are meticulously documented and explored in each step of the research process.</p> <p><b>Results:</b> 594 unique public software licenses were found from five different license listing sites. The found amount hints at the problem of too many public software licenses which might convert to the difficulty of understanding public software licenses, which again might lead to unexpected and unwanted legal agreements. Both research and industry have room for improvements such as new research using grey literature, use of <b>AGPL-3.0-or-later</b> or some other court-proven public software license and possibly supporting the new Post Open Source movement, that could revolutionize the software industry.</p> <p><b>Conclusions:</b> Future research efforts should start at adopting a clear baseline including the terminology. Future industry efforts should focus on trying to learn and understand the practical effects of the public software licenses being used.</p> <p><b>ACM Computing Classification System (CCS)</b><br/> Social and professional topics → Computing / technology policy → Intellectual property → Licensing</p> |                               |  |  |
| Avainsanat — Nyckelord — Keywords  |                               |  |  |
| open source, free / libre software, copyright, proprietary software, copyleft, license, post open source   |                               |  |  |
| Säilytyspaikka — Förvaringsställe — Where deposited  |                               |  |  |
| Helsinki University Library  |                               |  |  |
| Muita tietoja — övriga uppgifter — Additional information  |                               |  |  |
| Software study track   |                               |  |  |

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Dedicated to Artemis.

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# 1 Introduction

Public software licenses are central to the distribution of works in software engineering. In open source there must be an appropriate public software license attached to the source code in order for the piece of software to be freely available for possible modification and redistribution. Because open source is central to software engineering the licenses enabling open source should also be considered important in the same context.

The objective of this thesis is to have an understanding on how to retrieve all public licenses in software engineering by conducting a multivocal literature review (detailed goals are outlined in Sections 1.3 Thesis goal and contributions, 2.1 Research questions).

The review follows Kitchenham and Charter’s guidelines for systematic literature reviews (Kitchenham and Charters, 2007). Furthermore, the review takes into account insights from practical experiences with systematic reviews (Mahdavi-Hezavehi et al., 2013)(Nurmivaara, 2023).

## 1.1 Background

In this section we briefly describe the terminology and background of public software licenses which we use in this thesis. It is worth to note that the terminology is largely unestablished in the academics and heavily debated in the industry.

The definition of a public license is a license by which a copyright holder as licensor can grant additional copyright permissions to any and all persons in the general public as licensees (Hietanen, 2007) which is what we use in this thesis. By applying a public license to a work, provided that the licensees obey the terms and conditions of the license, copyright holders give permission for others to copy or change their work in ways that would otherwise infringe copyright law.

In this thesis we refer public software licenses as such public licenses that apply to software source code and the like. An example of the latter are fonts which are considered to be software and thus public software licenses can be applied to them. The public license types provided by the GNU Project (GNU, 2023) and listed in Table 1.1 are outside the scope when we use the term ”public software license” in this thesis.

|  |
|--|
| public licenses in documentation for example architecture documentation of a project that may or may not be software or even publicly licensed |
| public licenses in artistic works for example digital art, music or videos   |
| public licenses in educational works   |
| public licenses in viewpoints  |
| public licenses in physical objects  |
| public licenses in other works   |

**Table 1.1:** Scope of public non-software licenses

Another example of term inconsistency is the term "copyleft", which is defined by Mustonen (2003) in the following way:

"Copyleft is a novel licensing scheme. It facilitates open and decentralized software development. Its key feature is that once a program is licensed by the inventor, the subsequent programs based on the original must also be licensed similarly."

Like with the definition of sustainability (Neumayer, 1999), copyleft also has the definitions of weak and strong within the term (Wikipedians, 2025). Weak copyleft licenses are often used to cover software libraries. This allows other software to link to the library and be redistributed without the requirement for the linking software to also be licensed under the same terms. Strong copyleft shares the same features Mustonen, 2003 presents regardless of the library nature of a piece of software. The general use of the term "copyleft" without the prefix also leads to inconsistency in the term usage.

In this thesis we will use the following definitions for open source and free software. Open source is defined as any software source code that is licensed under a public software license that the Open Source Initiative (OSI) has approved as "open source". Free software is software that has source code licensed under a public software license that the Free Software Foundation (FSF) has approved as "free software". Since the most recognized public licenses in software engineering are either open-source licenses or free software licenses, let us explore further the differences and similarities between open source and free software at the software engineering level of public licenses. This is a crucial step



since majority of public software licenses are either open source, free software or both. We glanced over the free software definition in the beginning of Chapter 1. Open Source Initiative defines open-source licenses in the Open Source Definition briefly in the following way (OSI, 2024):

”Open source licenses are licenses that comply with the Open Source Definition  
- in brief, they allow software to be freely used, modified, and shared.”

Like the FSF with free software, OSI has the final word on what passes as open source and what does not. For example a new public software license will not classify as free software nor open source until the corresponding organization has acknowledged the public software license as either free software, open source or neither. If a public software license is accepted by both FSF and OSI, in this thesis it will fall under the term FLOSS. It is possible for an organization like the OSI or the FSF to accept a public software license, ignore it or actively reject it at any given point in history. In general the strong copyleft free software license requirements are considered more strict than the open source license requirements. For the sake of perspective and the viewpoint present in Chapter 4 we could simplify the differences like so: free software requires the redistributions of the licensed software to be open as well but open source licenses do not usually require this. The terms free software and open source are in general often misunderstood or just thought of as FLOSS collectively because the terms have a hard time conveying their paradigms in the natural language. A common mistake in understanding these two paradigms is that free software means software free of charge or that open source means that we can see the source code. We will glance over the impacts on the industry of these two terms in Chapter 4. For example The Open Source Initiative (OSI) classifies `GPL-3.0` under the term ”open source” whereas the Free Software Foundation (FSF) classifies `GPL-3.0` under the term ”free software” (OSI, 2008; Stallman, 2009). Some parts of the two definitions are mutually exclusive. This thesis will not use the terms free software and open source interchangeably.

## 1.2 Lack of license knowledge

Understanding public software licenses can be difficult. This could stem from the legal nature of the license texts and the large number of already-existing public software licenses. The license texts usually favors correctness over the readability for the developer. This

is because the license text has to act as a valid legal instrument otherwise it cannot be endorsed (Ferguson, 2006). The lack of understanding of public software licenses leaves too much room for interpretation. In 2023 IBM's Red Hat seemingly violated the spirit of a popular public software license, the GNU General Public License version 2 (GPL-2.0) (McGrath, 2023; Kuhn, 2023). This was an unpleasant surprise to the public. If the public software licenses would be more easily understood, the proprietarization of Red Hat Enterprise Linux (RHEL) would have been less of a surprise to the users. To give some context on the violation of the spirit of the GPL-2.0, the project behind GNU General Public License (GPL), GNU Project initially attempted to ensure the users via the GPL have to the following three freedoms (GNU, 1996):

- Freedom 1: The freedom to study how the program works, and change it so it does your computing as you wish. Access to the source code is a precondition for this.
- Freedom2: The freedom to redistribute copies so you can help others
- Freedom 3: The freedom to distribute copies of your modified versions to others. By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

On top of the legal details of public software licenses, based on the coverage of the incident we suspect that software engineers in general have a tough time understanding the pragmatic freedoms and restrictions of public licenses used in software engineering. In the instance of the RHEL incident it could have been even lesser of a surprise to software engineers if they would have known about other public software licenses. In the example of RHEL This knowledge could have inspired the industry and the academic to seek answers to why GPL-2.0 has been succeeded by GNU General Public License version 3 (GPL-3.0) in the first place.

As significant point of clarification, it is essential to acknowledge that public licenses are generally meant to be used as valid legal instruments. The question whether or not a public license can act as a legal instrument is critical to the main function of these licenses. However, this thesis will not focus on the legal doctrine aspects either. The enforceability of public licenses has seen discussion in the academic field of law since the dawn of these licenses and since there's already an academic base for research it is likely the discussion seems to continue on with a healthy amount of activity (Duisburg, 2011).

## 1.3 Thesis goal and contributions

The primary goal is to have an understanding on how to retrieve all public licenses in software engineering by conducting a multivocal literature review. The research aims to provide a novel perspective on relevant licenses and to extract key findings through a rigorous literature review process.

The target audience of this thesis' contributions is twofold. The first major contribution is to provide a rigorous multivocal research on public software licenses to the academic field. Because this thesis already does the multivocal work on public licenses in software engineering, the researches of the future can cite the results of this thesis without having to mark their study a multivocal one. The second main contribution is to provide insights and general metrics to the professional field of software engineering on public software licenses. Hopefully this makes conversation on public licenses in software engineering easier.

## 1.4 Thesis structure

Chapter 1 introduces the problem, this thesis' contributions and some further background. We state definitions and terminology used in the scope of this thesis. We go over the reasons why there does not exist consistent terminology in this area. Chapter 2 goes over the process and the methods of the multivocal literature review. This is where most of the actual research takes place in. Chapter 3 presents results to the research questions. Chapter 4 discusses implications for research. We include our own suggestions and basic knowledge for professionals and academics in the industry to enhance the understanding of public licenses in software engineering. The chapter also discusses software engineering professionals in the thesis' context and the validity of the thesis' research. Chapter 5 concludes this thesis with the help of the research questions and the future of the research.

## 2 Methods

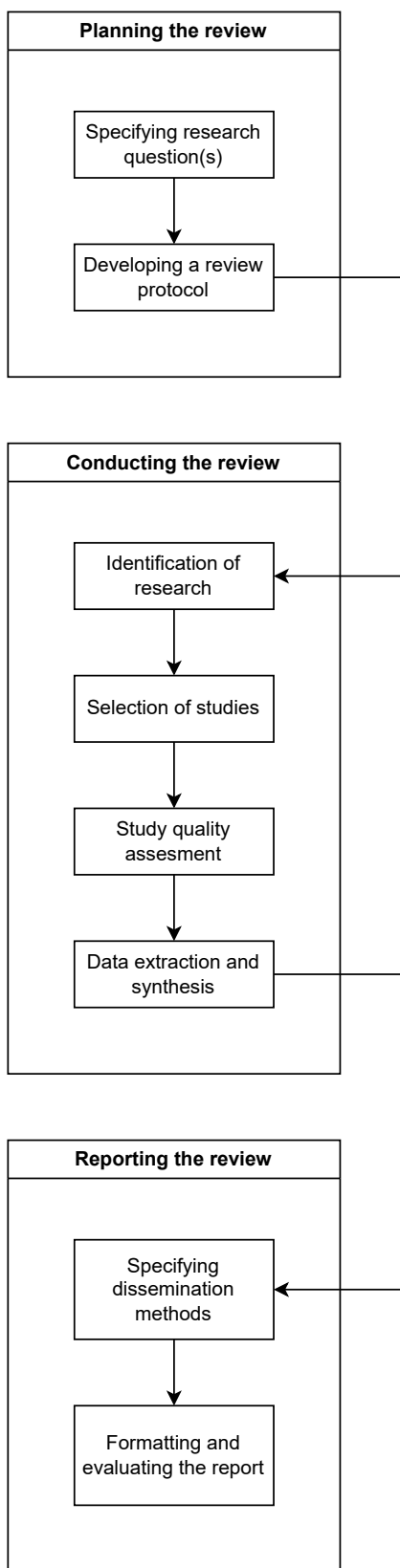
This chapter aims to establish a precisely defined and rigorous research approach to enhance transparency and repeatability. We will take the steps required to ensure that every phase and decision is thoroughly documented, enabling the reader to retrace the research process. In a thesis made by a single researcher, the lack of cross-examination of results with multiple researchers and the validation of evaluation criteria for opinion bias pose threats to validity, as will be clarified further in Chapter 4. Therefore, special attention will be paid to address these concerns. By following this approach, this research endeavors to contribute to the existing body of knowledge in the field of computer science in a robust and reliable manner.

### 2.1 Overview of the process

The systematic literature review method is a well-established approach for conducting a comprehensive and rigorous analysis of the existing research on specific research question or subject (Kitchenham and Charters, 2007). This paper presents a multivocal literature review. Multivocal literature review is type of systematic literature review that includes both academic literature and grey literature (Garousi et al., 2019). This method was selected for this study to facilitate a thorough and scientifically interdisciplinary examination of public licenses in software engineering. The existing literature consists of public software licenses not found in academic databases and as such are considered gray literature, making the thesis a multivocal literature review.

This study follows the guidelines outlined by Kitchenham and Charters, 2007, to ensure its quality. The multivocal review method consists of three distinct phases: planning, conducting and reporting the review. This study stricly adhered to this structure. The phases can be further broken down into a research protocol, as illustrated in Figure 2.1. Adhering to the protocol is the first step in ensuring a well-documented and rigorous process, which increases the validity and auditability of the study.

The multivocal literature review process began with the formulation of research questions and the establishment of a comprehensive search strategy and scope. The search process was conducted by employing a quasi-gold standard (QGS) approach based on the imple-



**Figure 2.1:** Three phases of a systematic literature review

mentation by Zhang and Ali Babar, 2010. After the completion of the search process, the inclusion and exclusion criteria were defined. To ensure a structured evaluation of the literature, a data extraction form was created. Finally, a strategy for analyzing the extracted data from the literature was designed.

To ensure the reliability and validity of the research protocol, it was validated against similar systematic literature reviews in computer science, the aforementioned guidelines by Kitchenham and Charters, 2007, and was further refined through an iterative process. Specifically, a subset of the data was tested on (The QGS) and any identified issues or problems were recorded and addressed. The details of this process are explained and thoroughly documented in the following sections. Similarly, the same approach was followed for the data extraction process, whereby a subset of literature was tested to refine the data extraction form. The revision of the form was undertaken as necessary to guarantee the completeness and accuracy of the extracted data.

## 2.2 Research questions

The research questions in this study served two primary purposes. Firstly, they aimed to provide an analysis of the existing multivocal literature on public licenses in software engineering for the researchers interested about the field. Secondly, the questions were designed to cater a secondary audience of professional software engineering practitioners. As discussed in the Chapter 1, the following research questions were addressed in this thesis:

- RQ1: How many public licenses in software engineering does there exist?
- RQ2: How consistent are the naming conventions for public licenses in software engineering

The multivocal literature review in this thesis begins with addressing RQ1, which aims to provide the amount of public software licenses that exist in our five public license listing sites in total. This information could be valuable for researchers but mostly it could be valuable to the practitioners since it could give some overview and a sense of the scale when picking a public software license that would serve the practitioners' needs the best. The results can be used to introduce some notable background of the current public licenses in software engineering and enabling focus to more specific areas inside the topic of this thesis.

Next RQ2 seeks to find the amount of duplicate licenses between the license listing sites. Results to this research question are also mostly useful to researchers of the field. The results give an overview of the naming consistency for these public software licenses. Moreover, the documented methods are most likely the most valuable information for the researchers.

Finally RQ3 attempts to count the total number of individual public software licenses within the scope of this thesis. The research question builds on top of the results and methods of the previous research questions. This information could be most valuable for the practitioners

## 2.3 Search strategy

The search process was conducted on five public license listing websites. The selection criteria for the literature were defined after the search process and the selection process was based on inclusion and exclusion criteria. The inclusion and exclusion criteria and each step of exclusion on the literature found are presented later in this chapter. Originally the search terms would have been applied to the license listing sites directly just like in a normal multivocal literature review or in a systematic literature review. Keywords however produced highly varying and non-reproducible results in Google Scholar and Google Search. Some license listing websites such as FSF's list of pages categorized as licenses could not be found from Google Search even with the `site` operator:

`site:https://directory.fsf.org/wiki/Category:License`. Although the page has been up since 2013, for some reason Google has not crawled the page in 10 years (FSF, 2024). This is why this thesis does not include search terms of the initial phase per se but rather inclusion and exclusion strings on the second phase. For the sake of validity the thesis still follows the guidelines presented in Kitchenham and Charters, 2007 with the exception of replacing an academic database search engine with the five license listing sites, web scraping and our own Python script performing the legwork of an academic database search engine in a systematic literature review.

The data extraction process was performed in a standardized and systematic manner, with the aim of obtaining the relevant information from the selected literature. The data extraction form used included license shortcode used in the listing site, listing site name, full license text and is available Table 2.1. The extracted data was then used to answer the research questions and perform the data analysis. The results of the data analysis

**Table 2.1:** License listing sites chosen

| URL   | Shortcode |
|---|-----------|
| <a href="https://spdx.org/licenses/">https://spdx.org/licenses/</a>   | SPDX      |
| <a href="https://wiki.debian.org/DFSGLicenses">https://wiki.debian.org/DFSGLicenses</a>                                   | DFSG      |
| <a href="https://directory.fsf.org/wiki?title=Category:License">https://directory.fsf.org/wiki?title=Category:License</a> | FSF       |
| <a href="https://opensource.org/licenses">https://opensource.org/licenses</a>   | OSI       |
| <a href="https://www.gnu.org/licenses/license-list.html">https://www.gnu.org/licenses/license-list.html</a>               | GNU       |

were then reported in a rigorous manner.

### 2.3.1 Search method

The search was conducted on five license listing websites shown Table 2.1, as mentioned earlier, to obtain a broad set of multivocal literature. This approach yielded a large number of literature that were processed to a subset of high-relevance literature using inclusion and exclusion criteria presented later in this chapter. Manual searching of databases with hundreds of public licenses is not feasible, and it is prone to researcher bias and may overlook relevant venues from other scientific disciplines. However, a preliminary manual search was performed to reduce the number of iterations required and establish the quasi-gold standard (QGS) mentioned earlier.

### 2.3.2 Search scope and terms

The search terms, or in our case, the inclusion and exclusion string was determined through an iterative process that took into account the research questions and topic. Synonyms for key terms were included and combined using Boolean logic to form a comprehensive inclusion and exclusion string. As mentioned earlier the inclusion and exclusion criteria are presented later in this chapter.

The inclusion and exclusion string was established on a basis of quasi-gold standard as proposed by Zhang and Ali Babar (2010). For establishing a quasi-gold standard we employed a manually crafted inclusion and exclusion string based on the topic and research questions of this study. As we defined public licenses in software engineering as licenses where the licensees are not limited and the license in question is meant be used in licensing



**Table 2.2:** MIT License Wikipedia page infobox

| Field                                      | Value                                |
|--|--------------------------------------|
| Publisher                                  | Massachusetts Insitute of Technology |
| SPDX identifier                            | MIT                                  |
| Debian FSG compatible                      | Yes                                  |
| FSF approved                               | Yes                                  |
| OSI approved                               | Yes                                  |
| GPL compatible                             | Yes                                  |
| Copyleft                                   | No                                   |
| Linking from code with a different license | Yes                                  |

software source code in Chapter 1 and our research questions focus on finding useful metrics about the public licenses, we manually formulated the inclusion and exclusion string in Python:

```
^(?!.*\b(documentation\s+license|creative\s+commons|open data)\b).*
```

In order to run the inclusion and exclusion string that established the quality-gold standard against the literature we had to gather them first. We started defining our search scope from the Wikipedia page of one of the most used open source license (Balter, 2015), the MIT license (Wikipedians, 2024). The infobox contained fields in the order shown in Table 2.2.

The validity threats regarding this choice are discussed in a later chapter. The publisher, GPL compatibility, copyleft and the linking exception did not result in any meaningful license listing websites. This leaves us with the SPDX, Debian FSG compatibility, FSF and OSI from which all resulted in some sort of license listing websites. Since the fields were roughly as follows: SPDX, FSF, OSI and GNU, after some investigating, we decided to start the search for public software licenses from the following license listing sites:

The web pages were scraped of the public license shortcodes using the browser’s developer tools. These shortcodes were imported into a spreadsheet editor with each shortcode under their corresponding listing site name. This resulted in over 1000 public licenses. Because the same public license would sometimes occur in multiple listing sites strictly duplicate shortcodes were removed using the spreadsheet editor resulting in 780 public licenses. Removing the duplicates was not intelligent and left duplicates like ZPL-2.0 and

ZPL - 2.0 as unique license shortcodes. The solution to this problem is presented in a later sub-chapter. The table in the state after the strict removal of duplicates is provided in this thesis' repository\* under the name of `stage1-licenses.md`.

With the search for the initial license listing websites completed we moved onto the search process itself.

## 2.4 Search process

The literature selection process was divided into multiple stages, as outlined in Figure 2.2. The initial step involved the formation of a inclusion and exclusion string through the use of a quasi-gold standard.

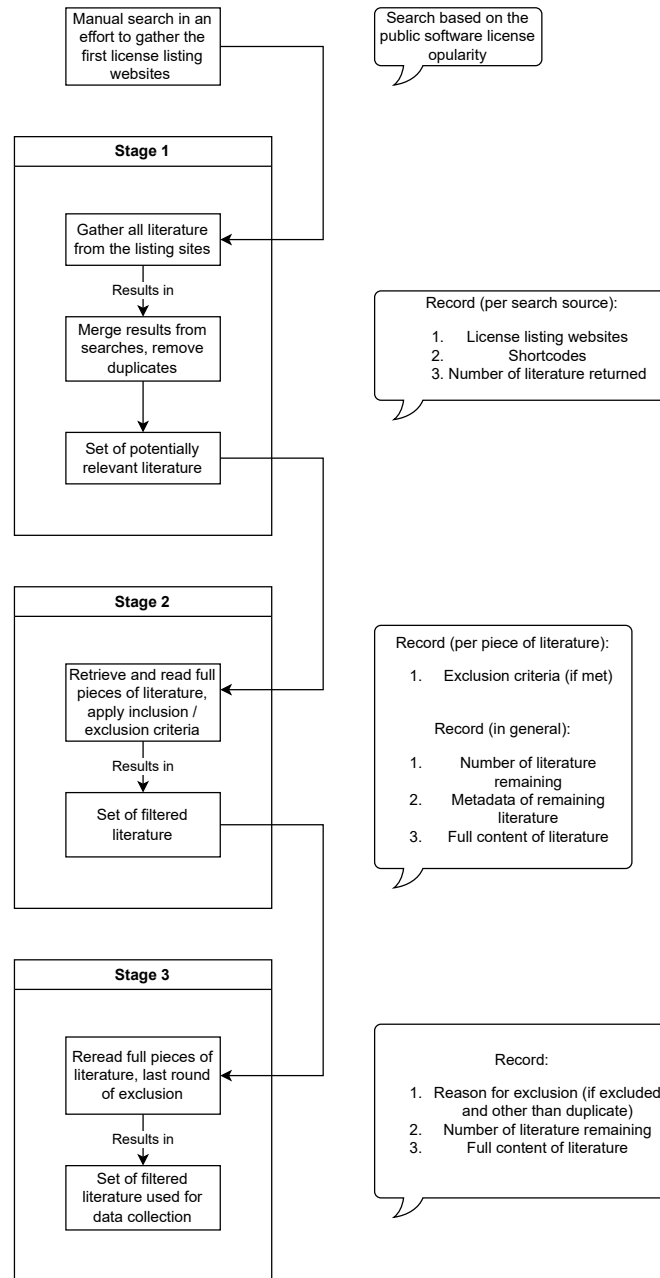
In the first stage, the search was conducted using the web pages titled "MIT License" (Wikipedians, 2024), "SPDX License List" (Linux Foundation, 2024), "The DFSG and Software Licenses" (Debian, 2024), FSF's "Category:License" Wiki page (FSF, 2024), GNU's "Various Licenses and Comments about Them" (GNU, 2023) and "OSI Approved licenses" (OSI, 2024) focusing, focusing on the license listing site name and shortcode. Then we identified and eliminated any duplicates, producing a preliminary set of potentially relevant literature. The dataset after the first stage of the search process is provided in this thesis' repository\* under the name of `stage1-licenses.md`, as mentioned earlier.

In the second stage, the inclusion and exclusion criteria were applied to further filter the literature and reduce the number of licenses to be reviewed. Then the resulting dataset was taken for a closer look where the quality of the literature was examined manually by the author, resulting in some manual exclusions based on the content and availability of the literature. This is where the inclusion and exclusion string took concrete place in which means the results were cross-referenced with the quasi-gold standard to validate it. The verbal reasoning for manual exclusions is clarified in Sub-chapter 2.4. The dataset after the second stage is provided in this thesis' repository\* under the name of `stage2-licenses.md`.

The third stage was the most time-consuming and involved a manual review of the full license texts. After reading and evaluating each license, a final round of exclusions was completed and documented. The remaining licenses were used for data collection and analysis in the final part of the study. The final list of licenses is available in Appendix A.

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\*<https://github.com/akirataguchi115/mscthesi/>

**Figure 2.2:** Search process divided into stages

## 2.5 Inclusion and exclusion criteria

Before we could apply the inclusion and exclusion criteria to the literature we had to fetch the full license texts from somewhere since the first stage’s dataset included only the shortcode and listing site name. We decided that the public license database by ScanCode published in GitHub (ScanCode, 2025) was to be used fetching the initial full license texts based on the shortcodes of the first stage. The license database could be found by searching GitHub with the term “license database”. The monolithic Python script used for this matching and fetching is provided in this thesis’ repository \* under the name of `methods.py`. Some shortcodes from the first stage did not match any full license texts from the license database. We had to manually fetch the missing full license texts from these license listing sites. The fetching was done systematically in cycles until no more missing full license texts were found with the help of the first stage spreadsheet. as can be seen from the Python script. We now had a complete Python dictionary with the shortcode as the key and full license text as the value.

To be eligible for the data collection and analysis, a license had to match the following inclusion and exclusion regular expression string:

```
^(?!.*\b(documentation\s+license|creative\s+commons|open data)\b).*
```

The regular expression string first included some inclusion matching but we soon realized it would be more efficient to exclude licenses than to include licenses. To establish the quasi-gold standard we first tried to exclude all full license texts including the words “creative commons” since we knew the Creative Commons licenses are not suitable for computer code, which is our scope. We then opened all excluded licenses into tabs in our text editor which the Python script assigned to their respective directory of excluded licenses based on the regular expression. We then looked quickly at the first few lines of the full license texts and judged if the license was indeed not suitable for our scope. Then we did the same to the included licenses in their respective directory and glanced if there were some types of licenses that were not suitable for our scope. We did one more cycle like this to finally exclude the string “documentation license” as well. During the two cycles we manually marked some licenses as included or excluded regardless of the regular expression matching since there did exist some corner cases the matching missed. This ended the second stage of search process which focused on inclusion and exclusion criteria.

---

\*<https://github.com/akirataguchi115/mscthesis/>

**Table 2.3:** Data extraction form

| #  | Field             | Concern/Research question |
|----|-------------------|---------------------------|
| F1 | Shortcode         | RQ2, RQ3                  |
| F2 | Listing site name | RQ1, RQ2                  |
| F3 | Full text         | Documentation             |

**Figure 2.3:** Number of literature per step of data collection

## 2.6 Data collection and data analysis

To answer the research questions of this thesis, a thorough examination of the selected primary literature was conducted and the necessary data was collected using data extraction form presented in Table 2.3. A record of the full license texts after the third stage was kept for analysis and is available as a directory called **stage3-licenses** in the thesis' repository\*.

To enhance transparency of the process, Figure 2.3 illustrates the progression of literature through each stage

To get the necessary from the remaining literature we decided that the next reasonable step was to remove duplicates from the licenses as systematically as possible. We used Python's **difflib** library to sort the full license texts. The library itself used the Ratcliff and Obershelp algorithm compare every full license text to every full license text. The time complexity is  $O(n^3)$  and  $\theta(n^2)$ . This took our working computer 68 minutes each time the algorithm ran so we decided to only do one cycle of this type of duplicate removal. The licenses were outputted to **duplicate-finding** directory with the naming convention

\*<https://github.com/akirataguchi115/mscthesis/>

of `n-shortcode.txt` where the `n` was the sort order given by the Ratcliff and Obershelp algorithm. We then opened these licenses to tabs in our text editor and compared the full license texts by human eyes if they were actually the same license with little to no noise difference in the full license texts. The comparison tool of our text editor was also a helpful automation tool for longer licenses that could not fit into one computer display as whole without scrolling. "open data" was also applied in the regular expression string at this stage. While this should have happened in stage 2, we wanted to be honest that this exclusion really did happen in stage 3. At this stage we also manually excluded individual licenses from the final dataset if there was too much noise. For example, GNU listed licenses often as whitespaces or something alike. Examples of these will be given in Chapter 3. This ended the third stage of the search process and provided us with the necessary data to answer the research questions.

The subsequent chapter presents the outcomes of the steps taken in the study, as discussed above.

# 3 Results

This chapter employs the data extracted from the set of primary literature, available in this thesis' repository\* under the name of `stage1-licenses.md`, utilizing the methods outlined in Chapter 2 to address the research questions. Firstly, a summary of the general statistics collected and aggregated from the studies is presented. Following that, an analysis of the data is performed to provide answers to each of the research questions.

VOIT SELITTÄÄ TÄSSÄ KAPPALEESSA, MITEN APPENDIX A LISTA EI OLLUT NETISSÄ VALMIINA NOIN VAIN

To begin with, the publication year was not limited and could not have been limited in a rigorous way. Almost all of the public software licenses came from different sources although they were listed in the five license listing sites. To give a rough estimate, one of the earliest public software license aiming for legal compliance was the original GPL from 1989 (Bernelin, 2020). The search was carried out by web scraping all of the licenses from the five license listing sites without any filters to the attributes of the licenses. The initial search results included 1057 public licenses, but after the exclusion and quality criteria of software-only license scope, the final resulting dataset was reached.

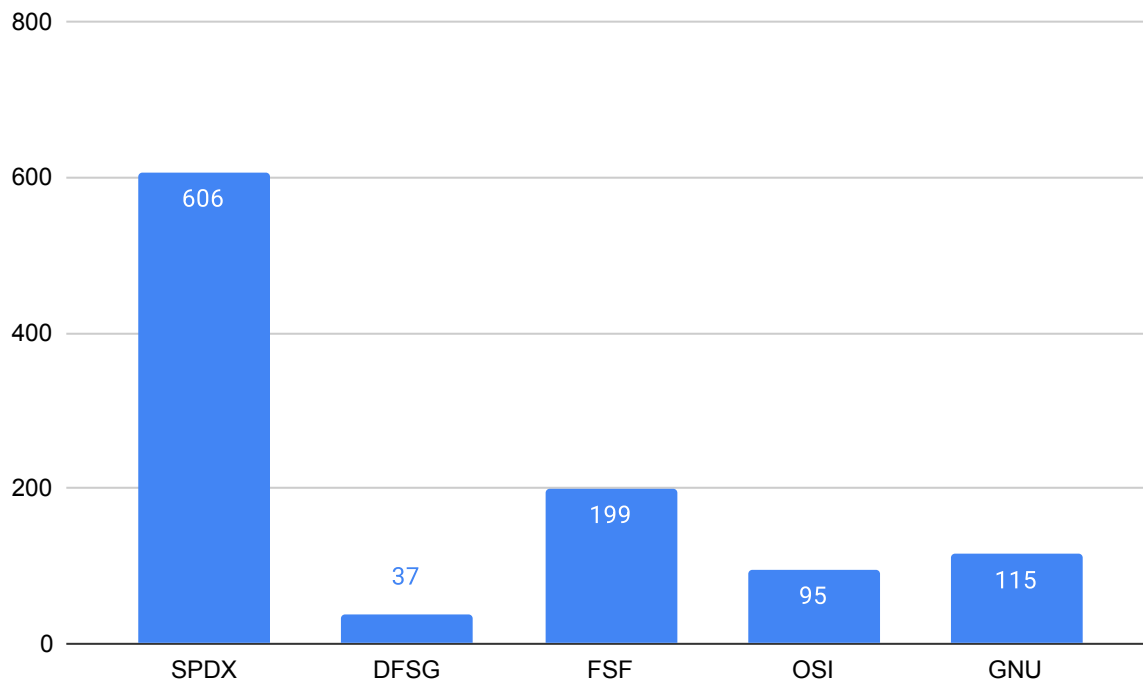
Given the large starting dataset, a simple statistical overview of the literature was generated and is presented in Figure 3.1 and Figure 3.2 with the full list of literature available in this thesis' repository\* under the name of `stage1-licenses.md`. The statistics highlight some immediate observations, such as the volume differences between the five sites and how the initial volume does not correlate to the number of duplicate one site holds compared to the four others.

POISTA TURHA TOISTO After establishing the quasi-gold standard and completing the preliminary study review outlined in Chapter 2, we systematically searched for relevant literature using the five license listing sites. The resulting search findings were filtered through a set of inclusion/exclusion criteria, followed by an extensive evaluation of quality before the final step of manual review. The final collection of literature consisted of almost 600 licenses, for which we obtained and reviewed the complete texts while completing the data extraction form as presented in Table 2.1.

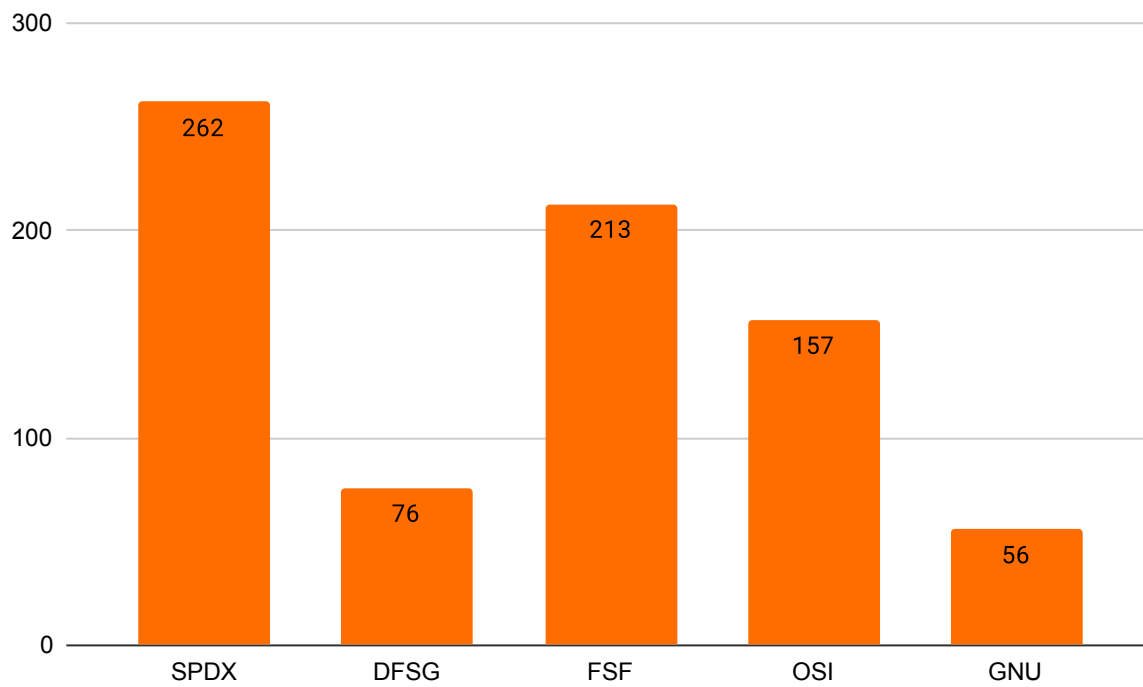
We observed the number of literature acquired is adequate to gain an representative

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\*<https://github.com/akirataguchi115/mscthesis/>



**Figure 3.1:** Licenses per site totaling in 1057 licenses



**Figure 3.2:** Duplicates licenses per site totaling in 1057 licenses



overview of the field, which we will explore further in this chapter.

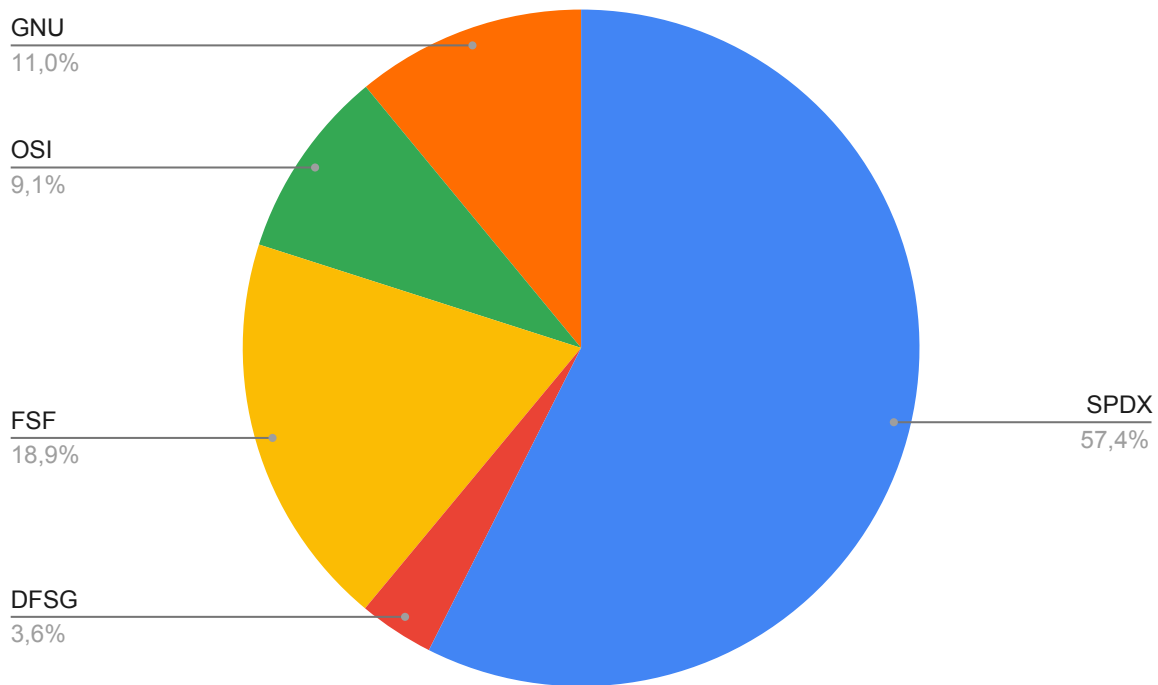
After this overview let us take a look into the specific research questions and their answers.

### 3.1 Five license listing sites and their licenses (RQ1)

Only license listing site during the first phase of the search process that did not give too much trouble was the SPDX. This was mostly be due to the table format used in that particular license listing site, shortcode identifier being provided inside that table and that it seems that SPDX preserves many of the licenses regardless of legal validity, superseding licenses or voluntary retirement.

The four other listing sites were more problematic to scrape. An example of DFSG is that for example for the license "Licence Art Libre (Free Art License)" I had to just use the more commonly used shortcode **FAL** because the shortcode itself was not listed in DFSG. FSF used a Wiki as the base for the license listing site so there was plenty of missing and outdated data. For example the original **Python** license has the full text of just "test" which indicates a pure mistake or a placeholder from the FSF. OSI had licenses that were retired between the search stages one and two. For example **cvw** was listed during the initial web scraping of the five listing sites but during the full license text fetching from the public license database of ScanCode the original creator of **cvw**, MITRE had voluntarily retired their license from the OSI license listing site and was no longer found from the OSI license listing site even though the missing license was noted to be from the OSI in the spreadsheet. The license was found however under the shortcode **cvw1** from the ScanCode public license database. This specific issue could have been solved by using an internet archiver, which we will discuss further in Chapter 4. GNU for example listed licenses like **attpubliclicense** which pointed the full license text to reside in and FSF site but the full license text was empty. In this case we had to just use the comments made by GNU as the full license text in this thesis.

These are just individual examples of the level of maintenance appearing in the four other license listing sites and some other examples will be brought up later in the next chapter. This is because solving these problems also becomes more of a validity threat of the author regardless of the fact that this kind observation is a relevant result on its own in this thesis. When we count the number of license per listing site after search stage one we get 607 licenses from the SPDX, 38 from the DFSG, 200 from the FSF, 96 from the OSI and 116 from GNU. The distribution of licenses from the five listing sites is illustrated in Figure



**Figure 3.3:** Distribution of license across the listing sites

3.3.

## 3.2 Duplicates in license listing sites (RQ2)

A total of 277 duplicates compared by exact shortcode after search stage one and 62 more duplicates were found after applying the exclusion criteria after search stage three. The initial 277 duplicates indicates some level of disagreement about the shortcodes between the five license listing sites. This is because these shortcodes are not treated unique across the listing sites. The following citation from GNU (GNU, 2023) about the MIT license demonstrates clearly the phenomenon affecting all five listing sites:

”Some people call this license ‘the MIT License,’ but that term is misleading, since MIT has used many licenses for software. It is also ambiguous, since the same people also call the X11 license ‘the MIT License,’ failing to distinguish them. We recommend not using the term ‘MIT License.’

The difference between the X11 license and the Expat license is that the X11 license contains an extra paragraph about using the X Consortium’s name. It

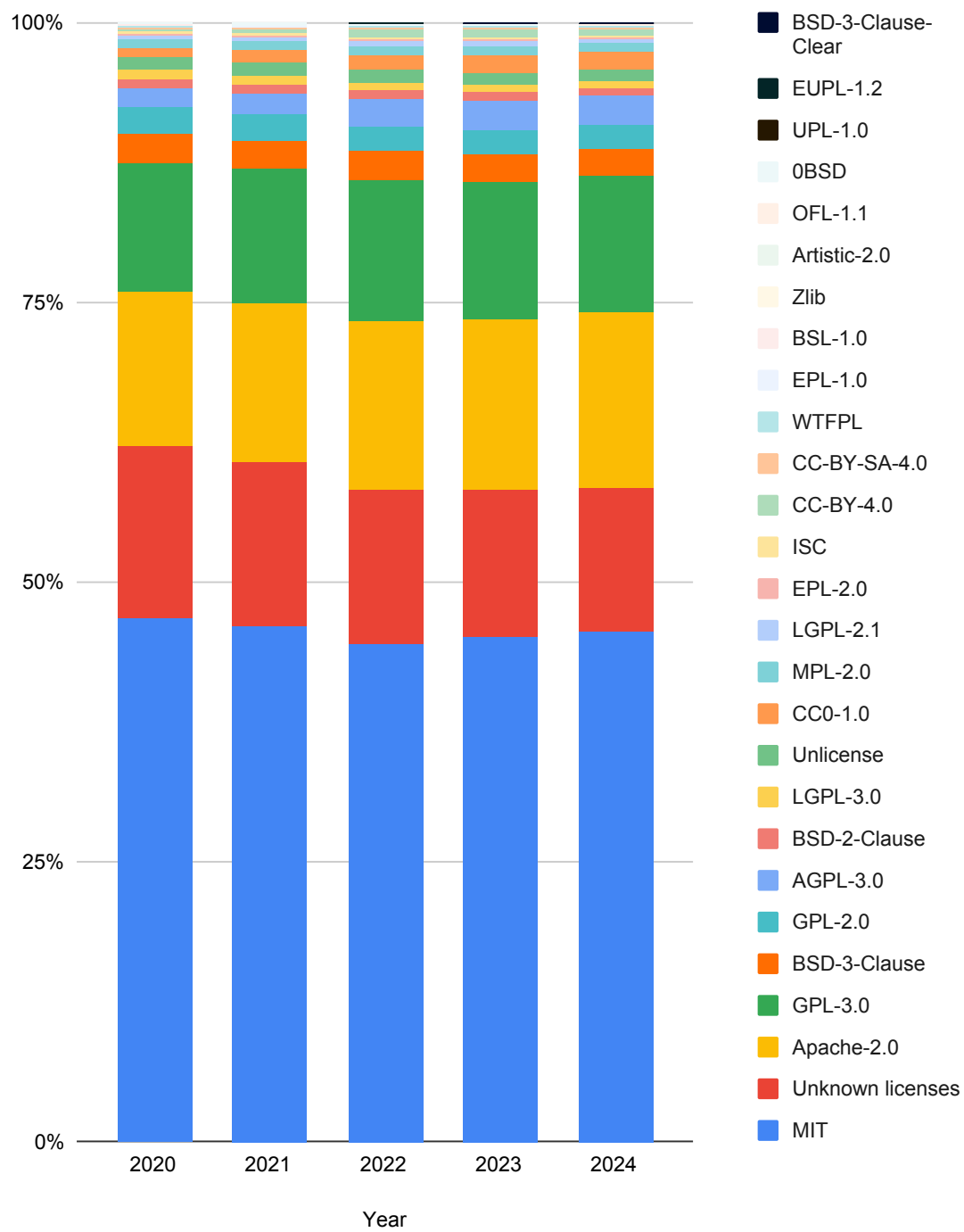
is not a big deal, but it is a real difference.”

GNU calls the MIT license as the **Expat** license. A notable observation being here that the MIT license was used in approximately 45% of repositories in 2015 (Balter, 2015) and with 4.8 million unique Git pushers in 2024 with the MIT license used as the license for the source code making the MIT license the most used license in GitHub in all four quarters of 2024 (GitHub, 2025). The same license was also used the most between the years 2020 and 2024 as can be seen in Figure 3.4. GNU demonstrates the same phenomenon of shortcode disagreement with the GPL-3.0 license being either **GPL-3.0-only** or **GPL-3.0-or-later**, disagreeing with any other shortcode stated by the other four listing sites (GNU, 2023). The 62 duplicates after search stage three fortifies our result that the unique shortcodes do not provide unique full license text between the license listing sites. We conclude that the FSF, DSFG, SPDX and the OSI share the same problem of disagreement between some license shortcodes.

### 3.3 Total number of public software licenses (RQ3)

A notable observation regarding the total number of existing public software licenses is that many of the licenses might not be considered legally valid in any court and many of them do not even try to be legally valid in the court. An example of the former, possibly not court-fireproof software license is the MIT. The breach of the license is not meant to be settled in court but rather just agreeing developer to developer that the distributed software contains MIT-licensed source code. Some examples of the latter include **Beerware** and **JSON** from which the former recommends buying a licensor a cold beverage and the latter forbids the use of software to evil purposes.

The total number of public software licenses after search stage three was 594. As mentioned before, in the last stage we excluded manually some licenses and removed some duplicates found using the Ratcliff and Obershelp similarity finding algorithm. The former included the original **Python** license, a Creative Commons license that did not have the words "creative commons" inside the full text and a Japanese Creative Commons license, which also did not have those words in English in the license full text. The 87 excluded licenses were also reviewed by their full license text and two exceptions were included manually. Both licenses were **CAL** licenses that are themselves licensed under a Creative Commons license so the exclusion filter gives us a false negative on these two licenses. We believe the number of unique public software licenses found, the record of



**Figure 3.4:** License usage between years 2020 and 2024 in GitHub with MIT being the most used public software license every year

the full license texts and their shortcodes available as a directory called `stage3-licenses` in the thesis' repository\* and the documented, systematic approach to finding answers to our three research questions, are the most notable results of this thesis. **KATSO ETTEI TÄNNE JÄÄ TÄLLAISTA TYNKÄÄ PALAUTUKSEEN**

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\*<https://github.com/akirataguchi115/mscthesis/>

## 4 Discussion

POHDI LYHYESTI MITÄ TULOXSIA RQ:HIN SAATIIN JA VOIT KERTO A PROS-  
ESSIN VAIKEUDESTA, SITTEN VASTA JATKA 4.1

This research indicates that the field of public licenses in software engineering, meaning public software licenses, is at an early stage of development. The review of existing literature reveals a notable absence of common set of definitions and terminology in this field. Consequently, this often leads to work covering the same ground. Furthermore, the variability of terminology across different literature makes it challenging to compare and synthesize results effectively. Addressing this challenge will require the development of common measurement tools and frameworks for evaluating and comparing public licenses in software engineering. Such efforts could lead to the establishment of widely adopted standards for measuring and improving public software licenses.

That said, there is clear interest in public licenses in software engineering. Although the amount of purely academic literature on public software licenses is limited, the amount of grey literature on public software licenses is ever increasing. This is most likely due to the recent developments in the field regarding proprietarization noted in the Chapter 1.

A notable observation of our reserach is that the recent efforts in the industry have led to the development of Post Open Source not yet noted in the research literature reviewed (Claburn, 2023). Whether or not this paradigm will change the industry like open source and free software did will only be evident over time. The paradigm is explained shortly in Chapter 5.

The quest to objectively categorize every public software license is a complex one. Therefore it is essential to continue taking the correct steps towards incresing the scientific understanding and providing the industry with examples, standards and processes to follow. However, as the previous chapters have revealed, a significant amount of effort is still being spent on solving the same problem multiple times, rather than building on existing knowledge and finding the next problem to solve. As the knowledge, conventions, and terminology take shape, we can look forward to reaching a state where less effort is spent on defining concepts and more on practical problem-solving.

## 4.1 Implications for research

**PERUSTA POHDINNAT TYÖN TULOKSIIN. TÄSSÄ KAPPALEESSA EI ENÄÄ UUSIA TULOKSIA, SIIRRÄ CH3 RESULTSIIN.** To improve the maturity of research methods employed in the field of public licenses in software engineering, researchers should aim to use more rigorous and comprehensive research methods. This may involve using larger and more diverse data sets, developing more sophisticated measurement tools, and conducting experiments that are representative of real-world scenarios.

Furthermore, researchers should strive to increase the transparency and reproducibility of their research by making their data and code openly available. This would enable other researchers to replicate and build upon their work, as well as facilitate the establishment of common standards and best practices.

Finally, it is important for researchers to publish more articles regardless of the grey literature included in the papers. Because there is largely only grey literature published in the twenty-first century in the field, the next academic articles will be multivocal by default. The non-multivocal, academic articles will follow but only after there are systematic, academic and multivocal articles published for the former to build on. The results presented here are modest but by working together, researchers and industry professionals could produce more useful research regarding public licenses in software engineering.

## 4.2 Implications for software engineering professionals

**TÄSSÄKIN PERUSTA POHDINNAT TYÖN TULOKSIIN** Software engineering professionals should start by educating themselves of the basics of public licenses in software engineering and incorporating it into their design and development processes. They should be mindful or strive to be mindful about the public licenses their third-party softwares are using and how it impacts their craft. Making a map of the public software licenses and their corresponding usecases might help plotting the larger picture.

However, it is important to acknowledge that the institutions should hold the greater responsibility of teaching the basics of public software licenses without getting too tangled up in history, politics or simply waving the field off as a form of human rights activism. The key focus points here being vocational schools, software engineering courses, college and

university since these are the timestamps where most software engineers start to produce code that need to be licensed or require the use of a licensed piece of software.

Overall, the lack of public software license knowledge regarding software engineering professionals points to the need of more education regarding public software licenses and the practical effects stemming from the application of these licenses.

### 4.3 Limitations and threats to validity

The major limitation of this study is that the subjective results could not be validated by multiple researchers. In a systematic review, it is standard practice and highly recommended to have at least two, if not more, individuals independently conduct the review processes and then cross validating the findings. This would result in the possibility of comparing individual exclusion decisions and other decisions, thereby increasing the credibility of the study. However, in this study, the methodology was thoroughly documented **EI TARVITSE ASSERTOIDA VALIDITEETTIA. HYVIN DOKUMENTOITU JA SUORITETTU TUTKIMUS EI TAKAA VALIDITEETTIA. JOHTOPÄÄTÖKSETHÄN SAATTAVAT OLLA TÄYSIN HULLUJA SILTI.**, which allows us to assert with confidence that the study has an appropriate level of validity.

As a work of single researcher, there is also a chance of inaccuracy and bias in the literature selection and filtering process. As much of the literature had to be reviewed manually and then included/excluded on a qualitative basis, this is a known limitation and a threat to validity. Multiple rounds of documented filtering and a clear paper trail of all decisions made keeps this threat in the acceptable levels.

#### 4.3.1 Limitations of literature selection for review

Efforts were made to ensure the inclusion of comprehensive set of literature in the search process. This was achieved by setting the starting point of license listing sites to the Wikipedia article of the MIT license.

**MAINITSE VALIDITY THREATTIEN NIMET ENNEN KUIN SELITÄT MITEN SE ILMENEE TÄSSÄ TUTKIMUKSESSA** The first phase of filtering has some notable limitations starting with the two license listing websites: SPDX and DFSG. Since the material was gathered to a spreadsheet program the duplicates were removed using the short identifier the listing page was using. Next we will concretize this threat. Suppose our



spreadsheet program has acquired the public license with an identifier MIT. The results of phase one will not include any other public license marked with the identifier MIT. In the worst case the identifier MIT could have actually been MIT-DFSG-edition but with the identifier of MIT. Since there were so many public software licenses in phase one it would not have been possible to check the uniqueness of all removed duplicates. One of the reasons why this would not have been feasible is that the listing sites would fetch the public license contents from another webpage or at the second worst case, from another website. The worst case is that the URL is dead and we get HTTP 404. The amount of public software licenses, duplicates and the lack of already existing tools makes this problem multilayered. However this is the level of integrity we decided to finish our study with.

FSF's listing site presented some limitations to the scope of this thesis. The license shortcoded as **other** was not a public license but instead a hyperlink to another listing webpage that listed programs that the FSF has not yet managed to document the license which the program uses. Although the one of the programs called **babl** was licensed as with "gplv3" the amount of undocumented programs was over 5200 at the time of observation. For this reason we are excluding the public software licenses found indirectly from the category **other**.

GNU project's listing site allowed us to use a shortcut of sorts which we will document here for the purposes of acknowledging the limitations of it. The table of contents at the listing site marked certain consecutive public software licenses as software public software licenses. On top of this the public software licenses were not organized into easily processable tables but rather in stacked on one another in rich text format. Although we decided to use regex on the HTML file the included public software licenses were only the ones that were simply under the header "Software licenses". In the worst case scenario GNU project could have misinterpreted some public software licenses as non-software licenses thus making this thesis exclude them with a wrong reason. While from a quick glance and the existence of the other four license listing sites, we think it is still worth documenting when it comes to validity and the integrity of this thesis. **TEE VÄLIOTSIKOITA TÄHÄN ALIKAPPALEESEEN**

On top of too heavy filters we would also like to document the too light filters in the literature selection for review. We can see from Appendix A that for example public software licenses with the literature identifiers L777 and L780 are almost the same regarding the shortcoded identifiers: ZPL - 2.1 and ZPL-2.1. The duplicate removal would have been

seemingly simple to execute on phase 1. However with the presence of over 700 pieces of literature we decided not to give special treatment to any potential set of duplicates. While it is most possible that OSI's ZPL - 2.1 is equivalent exactly to SPDX's ZPL-2.1 we could not be sure without looking at their contents. This could have resulted duplicate public software licenses in the literature selection for review but these type of duplicates are removed in phases 2 and 3 due to the public software licenses being read in full.

To finish this subsection we will discuss some more minor validity issues that did not fit into Chapter 3 but are regardless important to note for the integrity of the thesis. Stage three of the search process included a validity threat regarding the removal of duplicates. If two full license texts would seem duplicates we would check the two license listing sites' license pages for further investigation without using an internet archiver. This is a common validity threat on this thesis, that is not relying on an internet archiver on every source possible. Still, archiving more than a thousand license pages and accessing them would have been very slow process in terms of both archiving and accessing.

As can be seen in Chapter 2 the regular expression string was only an exclusion filter. Using an inclusion and exclusion resulted in difficulties to match all of the public software licenses. In other words it eventually turned out to be faster to match the excludable licenses than the includable licenses. The validity threat lying here is that only using an exclusion filter implicates a majority of the public licenses in our dataset to be public software licenses. An example of difficult to include public software license is the `wtfpl` which includes no evidence of it being a public software license but rather a general public license. However because `wtfpl` is a largely used in software source code as can be seen in Chapter 3. Another examples to back up this choice in exclusion-only are the font licenses that are considered public software licenses. With the exceptions inflating the inclusion regular expression string we eventually decided to only use the aforementioned exclusion filter. Before the decision our inclusion string looked like this:

```
(.*\b(source|software|program|code|module|public(s+)license|ware|
(w+)ware)\b).*
```

As mentioned earlier in the thesis the Wikipedia infobox order of license listing sites plays a heavy role in the literature selection. This manifests as a validity threat for example in removal of duplicates where the duplicates are removed from the lattermost listing site, giving a false sense of the majority of the public licenses coming from the formermost license listing sites like the SPDX. While this might be true due to the high volume of

literature from the formermost license listing sites in order of the Wikipedia infobox it is still a threat to validity. Because of this choice in our scope the accuracy of the origins of the licenses in the search stages is not as high as it could be.

FSF license listing site also had some other more minor issues than described earlier. Licenses like `DejaVu` and `DBG-3.0` did have an FSF license page found from the listing site but these pages only offered one single whitespace character as the full license text. Licenses like `CorkForkPL` also contained a whitespace as the full license text but included a note about a software that uses this license. Sometimes the full license text could be found by just clicking the provided hyperlink to the software mentioned which is what we did with `JahiaCSL`. Sometimes it would have required the author to download and unarchive source code to see the full license text or use an internet archiver on top of that due to broken hyperlinks or the software's website being down permanently. We solved this dilemma by deciding to only get the full license text if it was at maximum one click away from the original license listing page. In cases where the license was listed on the FSF license listing page as whitespace the full license text was fetched from the next license listing site in the Wikipedia infobox order if it existed there. For example the full license text for FSF's MPL was fetched from GNU under MPL-1.1. While we figured out reproducible rules to our literature selection phase it is fair to note that these are threats to validity regardless of the systematic nature of the remedies presented here.

A more general note on the systematicity of this thesis is due. Systematic does not equal to automatic. The author's human eyesight was for example a major factor to distinguish duplicates in literature selection in search stage three. Licenses were sorted by the Ratcliff and Obershelp, opened all search stage two licenses to tabs on the text editor, switched with keybinds between  $n - 1$ ,  $n$  and  $n + 1$  full license texts and removed licenses that the author concluded to be duplicates based on various factors described in Chapter 2. As can be seen the process is systematic and relies heavily on the use of various automated tools but much of the work is also on the responsibility of the author's eyesight, memory and overall judgement which makes this process far from automatic. It is also good to note that the Python script used in Chapter 2 does not work on Windows systems. This was tested to decrease the waiting time of the Ratcliff and Obershelp on a more powerful desktop computer. This is the last and most minor validity threat mentioned in this thesis regarding the literature selection for review.

**KOKO TÄMÄ PARAGRAAFI VOISI OLLA EHKÄ AIEMMIN** We made efforts to ensure the inclusion of comprehensive set of literature in the search process. However, as with

all systematic literature reviews, a comprehensive manual review of all literature would have been a formidable task. Therefore, additional filtering was conducted. This filtering was carried out in two phases, starting with the application of inclusion/exclusion criteria, followed by a second phase focused on evaluating the nature of the public software licenses and conducting a manual review. As a result of this second phase, a set of literature were excluded following a critical appraisal, with documentation and reasoning provided for each section. **SAATTAA VAIKUTTAA UHALTA KOKO PARAGRAAFI. VÄLTÄ VARSINKIN ADJEKTIVEJA TÄLLAISISSA**

As such we can note that the literature selection was done in a sufficient manner. **TOTEA MIELUUMMIN ETTÄ OHJEITA JA HYVIÄ KÄYTÄNTÖJÄ NOUDATETTIIN JNE**

### 4.3.2 Limitations in data extraction

The process of data extraction holds great significance in a systematic literature review, as it has a direct impact on the transparency and rationale of the paper. The data extraction approach was shallow due to the data extraction form being relatively small. As mentioned above, not much data could be easily nor verifiably extracted from our main grey literature, the five license listing sites. Despite the diligent efforts to eliminate researcher bias, which is a common concern in interpretive methods, it was not feasible to replicate this work by another individual for cross-referencing purposes. However, the study's validity **EDELLEEN EI VOI ASSERTOIDA VALIDITEETTIA, KOSKA ESIM. JOHTOPÄÄTÖKSET SAATTAVAT OLLA VÄÄRIÄ** can still be considered appropriate, due to the transparent steps taken and the use of a short, but well-defined data extraction format.

We still note that because of the lack of common standardized measurements and tooling for them, a considerable amount of personal consideration had to be done to bring the research results of the primary literature into a comparative state.

# 5 Conclusions

The primary objective of this study was to conduct an extensive review of public licenses in software engineering and offer support to both practitioners and reserachers. The study addressed the following research questions: **TÄÄLLÄ EI ENÄÄ YHTEENVETOA. TÄSSÄ OLISI HYVÄ OLLA TAKE HOME MESSAGE ELI MITÄ JÄÄ KÄTEEN JA MITÄ TÄSTÄ PITÄISI OPPIA. SIIRRÄ MIELUUMMIN CH4 ALKUUN**

**RQ1: How many licenses are there in the top five software license listing cites?** The results of this study reveal 607 public licenses listed from the SPDX, 38 from the DFSG, 200 from the FSF, 96 from the OSI and 116 from the GNU project with the four latter sites providing most difficulties in fetching and parsing the shortcodes and full license texts with additional problems in overlapping and contradicting information. This resulted in 1057 total licenses.

**RQ2: How much is there disagreement in the shortcode names between different public software licenses listing sites?** From the 1057 original licenses, some 339 licenses were removed as duplicates using their shortcodes. Reasons for this initial amount of duplicates were discussed and lay background and reasoning for the amount of disagreement in the shortcode names between our license listing sites.

**RQ3: How many public licenses in software engineering does there exist?** After a manual review of the literature gathered and processed, the study found that there are some 594 unique public software licensed listed that can be obtained systematically.

## 5.1 Future research

Future research efforts should start at adopting a clear baseline. The definition of free software, open source and everything in between and ultimately the insignificance of the categorization regarding these public software licenses. It is important for the future research to distinguish the terms used yet it is also as important to know that the for example not all free software licenses offer the same freedoms. **MAAILMAA EI VOI MUUTTAA, MUTTA YMMÄRRYSTÄ VOI SELKEYTTÄÄ. SELITÄ MITÄ TUTKIJAT MYÖSKÄÄN EIVÄT VOI TEHDÄ JA MITÄ VOIVAT TEHDÄ, ESIM. TERMINOLOGIAN VAKAUTTAMI-**

## NEN

In terms of research efforts, a research project that would concentrate on trade-offs and especially the harmful impacts of software projects that do not use a strong copyleft public software license could have significant effect. This project could benefit from the metrics that contain the most used public software licenses and the most significant public software licensed software, and the effects of using that license with the consideration of the impact of using a different license.

## 5.2 Future industry efforts

**EROTTELE PERUSTELUT OMIIN TULOSSIIN TAI MUIHIN OMIIN NÄKEMYKSIIN TMS** Future industry efforts should focus on trying to learn and understand the practical effects of each public software license used in a software project as a dependency or as an individual software project licensed under a public software license. Due to the loose definition of open source companies like OpenAI have nothing to do with open source and large language models classes like Meta's Llama 4 are not open source although it is marketed as "Open-Source". Because open source is often seen as altruistic and generally speaking good for the image of a company, the industry continues to see "openwashing" just like greenwashing is used to market something as "green" when it in reality is not. As we have seen in this thesis' results, the definition of open source truly is too loose as it covers even licenses like **Beerware** and **JSON** where payments are in optional alcoholic beverages and restrictions are good and evil. This is why another one of the creators of the original Open Source Definition, Bruce Perens left the initiative (Claburn, 2020). Perens has then proposed a successor to Open Source called Post Open Source. The paradigm combines new public software licenses, existing public software licenses and a practice where one singular organization would gather the money from larger corporations using post open software and distribute it to the contributors of the post open licensed software. It remains to be seen whether or not this will revolutionize the future industry of software engineering.

When it comes to licensing new code from the ground up the near future industry should pay close attention to choosing a sustainable license. As mentioned earlier some of the licenses are not even meant to be court-proof. Licenses like the **GPL** are constantly trialed by fire in the court and are successfully defending software freedom even today (Casanova, 2024). Although even more copyleft-oriented public software licenses like the **Watcom** exist,

the author recommends licensing software source code under **AGPL-3.0-or-later** where possible due to its strong copyleft attributes and freedoms but mostly the court-proof nature of it as well.

In conclusion, this thesis has provided a systematic review of the current state of research on public licenses in software engineering. Through a systematic literature review, we have identified the amount of unique public software licenses and the methods of obtaining these licenses in a systematic way. The results of this study indicate that the field of public licenses in software engineering is still immature, with a lack of common standards, definitions, and tooling. However, this also provides an opportunity for further research and development in this area. It is our hope that the findings of this study will serve as a starting point for future research and industry efforts to build the standards and tooling required for more thorough analysis and information sharing, leading to more sustainable software engineering practices.

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## Appendix A Primary literature reviewed, read in full and data extracted

**Table A.1:** Final list of literature with the inclusion/exclusion criteria applied.

| Literature identifier | Shortcode                | SPDX | DFSG | FSF | OSI | GNU |
|-----------------------|--------------------------|------|------|-----|-----|-----|
| L1                    | 0BSD                     | SPDX |      |     | OSI |     |
| L2                    | 996                      |      |      | FSF |     |     |
| L3                    | AAL                      | SPDX |      |     | OSI |     |
| L4                    | Abstyles                 | SPDX |      |     |     |     |
| L5                    | ACEL                     |      |      | FSF |     |     |
| L6                    | AdaCore-doc              | SPDX |      |     |     |     |
| L7                    | Adobe-2006               | SPDX |      |     |     |     |
| L8                    | Adobe-Display-PostScript | SPDX |      |     |     |     |
| L9                    | Adobe-Glyph              | SPDX |      |     |     |     |
| L10                   | Adobe-Utopia             | SPDX |      |     |     |     |
| L11                   | ADSL                     | SPDX |      |     |     |     |
| L12                   | AFL-1.1                  | SPDX |      |     |     |     |
| L13                   | AFL-1.2                  | SPDX |      |     |     |     |
| L14                   | AFL-2.0                  | SPDX |      |     |     |     |
| L15                   | AFL-2.1                  | SPDX |      |     |     |     |
| L16                   | AFL-3.0                  | SPDX |      | FSF | OSI |     |
| L17                   | Afmparse                 | SPDX |      |     |     |     |
| L18                   | AGPL-1.0-only            | SPDX |      | FSF |     |     |
| L19                   | AGPL-1.0-or-later        | SPDX |      | FSF |     |     |
| L20                   | AGPL-3.0-only            | SPDX | DFSG | FSF | OSI |     |
| L21                   | AGPL-3.0-or-later        | SPDX |      | FSF |     |     |
| L22                   | Aladdin                  | SPDX |      | FSF |     | GNU |
| L23                   | Aladdin-9                |      |      | FSF |     |     |
| L24                   | AMDPLPA                  | SPDX |      |     |     |     |
| L25                   | AML                      | SPDX |      |     |     |     |
| L26                   | AML-glslang              | SPDX |      |     |     |     |
| L27                   | AMPAS                    | SPDX |      |     |     |     |

|     |                         |      |      |     |     |     |
|-----|-------------------------|------|------|-----|-----|-----|
| L28 | ANTI-1.3                |      |      | FSF |     |     |
| L29 | ANTI-1.4                |      |      | FSF |     |     |
| L30 | ANTLR-PD                | SPDX |      |     |     |     |
| L31 | ANTLR-PD-fallback       | SPDX |      |     |     |     |
| L32 | Apache-1.0              | SPDX |      | FSF |     |     |
| L33 | Apache-1.1              | SPDX |      | FSF | OSI |     |
| L34 | Apache-2.0              | SPDX | DFSG | FSF | OSI |     |
| L35 | APAFML                  | SPDX |      |     |     |     |
| L36 | APL-1.0                 | SPDX |      |     | OSI |     |
| L37 | App-s2p                 | SPDX |      |     |     |     |
| L38 | APSL-1.0                | SPDX |      | FSF |     |     |
| L39 | APSL-1.1                | SPDX |      | FSF |     |     |
| L40 | APSL-1.2                | SPDX |      | FSF |     |     |
| L41 | APSL-2.0                | SPDX | DFSG | FSF | OSI |     |
| L42 | Arphic-1999             | SPDX |      |     |     |     |
| L43 | Artistic-1.0            | SPDX |      | FSF | OSI |     |
| L44 | Artistic-1.0-cl8        | SPDX |      |     |     |     |
| L45 | Artistic-1.0-Perl       | SPDX |      | FSF | OSI |     |
| L46 | Artistic-2.0            | SPDX | DFSG | FSF | OSI |     |
| L47 | ASWF-Digital-Assets-1.0 | SPDX |      |     |     |     |
| L48 | ASWF-Digital-Assets-1.1 | SPDX |      |     |     |     |
| L49 | ATTPublicLicense        |      |      |     |     | GNU |
| L50 | Baekmuk                 | SPDX |      |     |     |     |
| L51 | Bahyph                  | SPDX |      |     |     |     |
| L52 | Barr                    | SPDX |      |     |     |     |
| L53 | bcrypt-Solar-Designer   | SPDX |      |     |     |     |
| L54 | Beerware                | SPDX |      |     |     |     |
| L55 | BerkeleyDB              |      |      |     |     | GNU |
| L56 | Bitstream-Charter       | SPDX |      |     |     |     |
| L57 | Bitstream-Vera          | SPDX |      |     |     |     |
| L58 | BitTorrent-1.0          | SPDX |      |     |     |     |
| L59 | BitTorrent-1.1          | SPDX |      | FSF |     |     |
| L60 | blessing                | SPDX |      |     |     |     |
| L61 | BlueOak-1.0.0           | SPDX |      |     | OSI |     |
| L62 | Boehm-GC                | SPDX |      |     |     |     |

|     |                                      |      |      |     |     |
|-----|--------------------------------------|------|------|-----|-----|
| L63 | Borceux                              | SPDX |      |     |     |
| L64 | Brian-Gladman-2-Clause               | SPDX |      |     |     |
| L65 | Brian-Gladman-3-Clause               | SPDX |      |     |     |
| L66 | BSD-1-Clause                         | SPDX |      | FSF | OSI |
| L67 | BSD-2-Clause                         | SPDX |      | FSF |     |
| L68 | BSD-2-Clause-Darwin                  | SPDX |      |     |     |
| L69 | BSD-2-Clause-FreeBSD                 |      |      | FSF |     |
| L70 | BSD-2-Clause-Patent                  | SPDX |      |     | OSI |
| L71 | BSD-2-Clause-Views                   | SPDX |      |     |     |
| L72 | BSD-3-Clause                         | SPDX | DFSG | FSF | OSI |
| L73 | BSD-3-Clause-acpica                  | SPDX |      |     |     |
| L74 | BSD-3-Clause-Attribution             | SPDX |      |     |     |
| L75 | BSD-3-Clause-Clear                   | SPDX |      | FSF |     |
| L76 | BSD-3-Clause-flex                    | SPDX |      |     |     |
| L77 | BSD-3-Clause-HP                      | SPDX |      |     |     |
| L78 | BSD-3-Clause-LBNL                    | SPDX |      |     | OSI |
| L79 | BSD-3-Clause-Modification            | SPDX |      |     |     |
| L80 | BSD-3-Clause-No-Military-License     | SPDX |      |     |     |
| L81 | BSD-3-Clause-No-Nuclear-License      | SPDX |      |     |     |
| L82 | BSD-3-Clause-No-Nuclear-License-2014 | SPDX |      |     |     |
| L83 | BSD-3-Clause-No-Nuclear-Warranty     | SPDX |      |     |     |
| L84 | BSD-3-Clause-Open-MPI                | SPDX |      |     |     |
| L85 | BSD-3-Clause-Sun                     | SPDX |      |     |     |
| L86 | BSD-4-Clause                         | SPDX |      | FSF |     |
| L87 | BSD-4-Clause-Shortened               | SPDX |      |     |     |
| L88 | BSD-4-Clause-UC                      | SPDX |      |     |     |
| L89 | BSD-4.3RENO                          | SPDX |      |     |     |
| L90 | BSD-4.3TAHOE                         | SPDX |      |     |     |
| L91 | BSD-Advertising-Acknowledgement      | SPDX |      |     |     |
| L92 | BSD-Attribution-HPND-disclaimer      | SPDX |      |     |     |
| L93 | BSD-Inferno-Nettverk                 | SPDX |      |     |     |
| L94 | BSD-Protection                       | SPDX |      |     |     |
| L95 | BSD-Source-beginning-file            | SPDX |      |     |     |
| L96 | BSD-Source-Code                      | SPDX |      |     |     |

|      |                                 |      |     |     |
|------|---------------------------------|------|-----|-----|
| L97  | BSD-Systemics                   | SPDX |     |     |
| L98  | BSD-Systemics-W3Works           | SPDX |     |     |
| L99  | BSL-1.0                         | SPDX | FSF | OSI |
| L100 | BUSL-1.1                        | SPDX |     |     |
| L101 | bzip2-1.0.6                     | SPDX |     |     |
| L102 | C-UDA-1.0                       | SPDX |     |     |
| L103 | CAL-1.0                         | SPDX |     | OSI |
| L104 | CAL-1.0-Combined-Work-Exception | SPDX |     |     |
| L105 | Caldera                         | SPDX |     |     |
| L106 | Caldera-no-preamble             | SPDX |     |     |
| L107 | CATOSL-1.1                      | SPDX |     |     |
| L108 | CDDL-1.0                        | SPDX | FSF |     |
| L109 | CDDL-1.1                        | SPDX |     |     |
| L110 | CDLA-Permissive-1.0             | SPDX |     |     |
| L111 | CDLA-Permissive-2.0             | SPDX |     |     |
| L112 | CDLA-Sharing-1.0                | SPDX |     |     |
| L113 | CECILL-1.0                      | SPDX |     |     |
| L114 | CECILL-1.1                      | SPDX |     |     |
| L115 | CECILL-2.0                      | SPDX | FSF |     |
| L116 | CECILL-2.1                      | SPDX |     | OSI |
| L117 | CECILL-B                        | SPDX |     |     |
| L118 | Cecill-B-v1                     |      | FSF |     |
| L119 | CECILL-C                        | SPDX |     |     |
| L120 | Cecill-C-v1                     |      | FSF |     |
| L121 | CERN-OHL-1.1                    | SPDX |     |     |
| L122 | CERN-OHL-1.2                    | SPDX |     |     |
| L123 | CERN-OHL-P-2.0                  | SPDX |     | OSI |
| L124 | CERN-OHL-S-2.0                  | SPDX |     | OSI |
| L125 | CERN-OHL-W-2.0                  | SPDX |     | OSI |
| L126 | CFITSIO                         | SPDX |     |     |
| L127 | check-cvs                       | SPDX |     |     |
| L128 | checkmk                         | SPDX |     |     |
| L129 | ClArtistic                      | SPDX | FSF |     |
| L130 | Clips                           | SPDX |     |     |
| L131 | CMU-Mach                        | SPDX |     |     |

|      |                            |      |      |     |     |
|------|----------------------------|------|------|-----|-----|
| L132 | CMU-Mach-nodoc             | SPDX |      |     |     |
| L133 | CNRI                       |      |      | FSF |     |
| L134 | CNRI-Jython                | SPDX |      |     |     |
| L135 | CNRI-Python                | SPDX |      |     | OSI |
| L136 | CNRI-Python-GPL-Compatible | SPDX |      |     |     |
| L137 | COIL-1.0                   | SPDX |      |     |     |
| L138 | Commons-Clause             |      |      | FSF |     |
| L139 | Condor-1.1                 | SPDX |      | FSF |     |
| L140 | copyleft-next-0.3.0        | SPDX |      |     |     |
| L141 | copyleft-next-0.3.1        | SPDX |      |     |     |
| L142 | Cornell-Lossless-JPEG      | SPDX |      |     |     |
| L143 | CPAL-1.0                   | SPDX | DFSG | FSF | OSI |
| L144 | CPL-1.0                    | SPDX | DFSG | FSF | OSI |
| L145 | CPOL-1.02                  | SPDX |      | FSF |     |
| L146 | Cronyx                     | SPDX |      |     |     |
| L147 | Crossword                  | SPDX |      |     |     |
| L148 | CryptixGL                  |      |      | FSF |     |
| L149 | CrystalStacker             | SPDX |      |     |     |
| L150 | CUA-OPL-1.0                | SPDX |      |     |     |
| L151 | Cube                       | SPDX |      |     |     |
| L152 | curl                       | SPDX |      | FSF |     |
| L153 | cvw                        |      |      |     | OSI |
| L154 | D-FSL-1.0                  | SPDX |      |     |     |
| L155 | DEC-3-Clause               | SPDX |      |     |     |
| L156 | Design-Science-L           |      |      | FSF |     |
| L157 | diffmark                   | SPDX |      |     |     |
| L158 | DL-DE-BY-2.0               | SPDX |      |     |     |
| L159 | DL-DE-ZERO-2.0             | SPDX |      |     |     |
| L160 | DOC                        | SPDX |      |     |     |
| L161 | Dotseqn                    | SPDX |      |     |     |
| L162 | DRL-1.0                    | SPDX |      |     |     |
| L163 | DRL-1.1                    | SPDX |      |     |     |
| L164 | DSDP                       | SPDX |      |     |     |
| L165 | dtoa                       | SPDX |      |     |     |
| L166 | dvipdfm                    | SPDX |      |     |     |

|      |                              |      |      |     |     |     |
|------|------------------------------|------|------|-----|-----|-----|
| L167 | ECL-1.0                      | SPDX |      |     |     |     |
| L168 | ECL-2.0                      | SPDX |      | FSF | OSI |     |
| L169 | ECos-2.0                     |      |      | FSF | OSI |     |
| L170 | EFL-1.0                      | SPDX |      |     | OSI |     |
| L171 | EFL-2.0                      | SPDX |      | FSF | OSI |     |
| L172 | eGenix                       | SPDX |      |     |     |     |
| L173 | Elastic-2.0                  | SPDX |      |     |     |     |
| L174 | Entessa                      | SPDX |      |     |     |     |
| L175 | EPICS                        | SPDX |      | FSF |     |     |
| L176 | EPL-1.0                      | SPDX | DFSG | FSF | OSI |     |
| L177 | EPL-2.0                      | SPDX |      | FSF | OSI |     |
| L178 | ErlPL-1.1                    | SPDX |      | FSF |     |     |
| L179 | EUDatagrid                   | SPDX |      | FSF | OSI | GNU |
| L180 | EUPL-1.0                     | SPDX |      |     |     |     |
| L181 | EUPL-1.1                     | SPDX |      | FSF | OSI |     |
| L182 | EUPL-1.2                     | SPDX |      |     | OSI |     |
| L183 | Eurosym                      | SPDX |      |     |     |     |
| L184 | Expat                        |      |      | FSF |     | GNU |
| L185 | Fair                         | SPDX |      |     |     |     |
| L186 | FAL                          |      | DFSG |     |     |     |
| L187 | FBM                          | SPDX |      |     |     |     |
| L188 | FDK-AAC                      | SPDX |      |     |     |     |
| L189 | Ferguson-Twofish             | SPDX |      |     |     |     |
| L190 | Frameworkx-1.0               | SPDX |      |     |     |     |
| L191 | FreeBSD-DOC                  | SPDX |      |     |     |     |
| L192 | FreeImage                    | SPDX |      |     |     |     |
| L193 | FSFAP                        | SPDX |      | FSF |     |     |
| L194 | FSFAP-no-warranty-disclaimer | SPDX |      |     |     |     |
| L195 | FSFUL                        | SPDX |      |     |     |     |
| L196 | FSFULLR                      | SPDX |      |     |     |     |
| L197 | FSFULLRWD                    | SPDX |      |     |     |     |
| L198 | FTL                          | SPDX |      | FSF |     |     |
| L199 | Furuseth                     | SPDX |      |     |     |     |
| L200 | fwlw                         | SPDX |      |     |     |     |
| L201 | GCR-docs                     | SPDX |      |     |     |     |



|      |                           |      |      |     |     |     |
|------|---------------------------|------|------|-----|-----|-----|
| L202 | GD                        | SPDX |      |     |     |     |
| L203 | Giftware                  | SPDX |      |     |     |     |
| L204 | GL2PS                     | SPDX |      | FSF |     |     |
| L205 | Glide                     | SPDX |      |     |     |     |
| L206 | Glulxe                    | SPDX |      |     |     |     |
| L207 | GLWTPL                    | SPDX |      |     |     |     |
| L208 | gnuplot                   | SPDX |      | FSF |     | GNU |
| L209 | GPL-1.0-only              | SPDX |      | FSF |     |     |
| L210 | GPL-1.0-or-later          | SPDX |      | FSF |     |     |
| L211 | GPL-2.0-only              | SPDX |      | FSF |     |     |
| L212 | GPL-2.0-or-later          | SPDX |      | FSF |     |     |
| L213 | GPL-3.0-only              | SPDX | DFSG | FSF | OSI |     |
| L214 | GPL-3.0-or-later          | SPDX |      | FSF |     |     |
| L215 | GPL-PA                    |      |      | FSF |     |     |
| L216 | Graphics-Gems             | SPDX |      |     |     |     |
| L217 | gSOAP-1.3b                | SPDX |      |     |     |     |
| L218 | gtkbook                   | SPDX |      |     |     |     |
| L219 | HaskellReport             | SPDX |      |     |     |     |
| L220 | hdparm                    | SPDX |      |     |     |     |
| L221 | HESSLA                    |      |      | FSF |     | GNU |
| L222 | Hippocratic-2.1           | SPDX |      |     |     |     |
| L223 | HP-1986                   | SPDX |      |     |     |     |
| L224 | HP-1989                   | SPDX |      |     |     |     |
| L225 | HPND                      | SPDX |      | FSF |     | GNU |
| L226 | HPND-DEC                  | SPDX |      |     |     |     |
| L227 | HPND-doc                  | SPDX |      |     |     |     |
| L228 | HPND-doc-sell             | SPDX |      |     |     |     |
| L229 | HPND-export-US            | SPDX |      |     |     |     |
| L230 | HPND-export-US-modify     | SPDX |      |     |     |     |
| L231 | HPND-Fenneberg-Livingston | SPDX |      |     |     |     |
| L232 | HPND-INRIA-IMAG           | SPDX |      |     |     |     |
| L233 | HPND-Kevlin-Henney        | SPDX |      |     |     |     |
| L234 | HPND-Markus-Kuhn          | SPDX |      |     |     |     |
| L235 | HPND-MIT-disclaimer       | SPDX |      |     |     |     |
| L236 | HPND-Pbmplus              | SPDX |      |     |     |     |

|      |                                  |      |      |     |     |     |
|------|----------------------------------|------|------|-----|-----|-----|
| L237 | HPND-sell-MIT-disclaimer-xserver | SPDX |      |     |     |     |
| L238 | HPND-sell-regexpr                | SPDX |      |     |     |     |
| L239 | HPND-sell-variant                | SPDX |      |     |     |     |
| L240 | HPND-sell-variant-MIT-disclaimer | SPDX |      |     |     |     |
| L241 | HPND-UC                          | SPDX |      |     |     |     |
| L242 | HTMLTIDY                         | SPDX |      |     |     |     |
| L243 | IBM-pibs                         | SPDX |      |     |     |     |
| L244 | IBMPL                            |      |      |     |     | GNU |
| L245 | ICU                              | SPDX |      |     | OSI |     |
| L246 | IEC-Code-Components-EULA         | SPDX |      |     |     |     |
| L247 | IJG                              | SPDX |      | FSF |     | GNU |
| L248 | IJG-short                        | SPDX |      |     |     |     |
| L249 | ImageMagick                      | SPDX |      |     |     |     |
| L250 | iMatix                           | SPDX |      | FSF |     | GNU |
| L251 | imlib                            |      |      |     |     | GNU |
| L252 | Imlib2                           | SPDX |      | FSF |     |     |
| L253 | Info-ZIP                         | SPDX |      | FSF |     |     |
| L254 | informal                         |      |      |     |     | GNU |
| L255 | Inner-Net-2.0                    | SPDX |      |     |     |     |
| L256 | Intel                            | SPDX |      | FSF |     | GNU |
| L257 | Intel-ACPI                       | SPDX |      | FSF |     |     |
| L258 | Interbase-1.0                    | SPDX |      |     |     |     |
| L259 | IPA                              | SPDX |      | FSF | OSI |     |
| L260 | IPL-1.0                          | SPDX | DFSG | FSF |     |     |
| L261 | ISC                              | SPDX | DFSG | FSF | OSI | GNU |
| L262 | ISC-Veillard                     | SPDX |      |     |     |     |
| L263 | JahiaCSL                         |      |      | FSF |     |     |
| L264 | Jam                              | SPDX |      |     | OSI |     |
| L265 | JasPer-2.0                       | SPDX |      |     |     |     |
| L266 | JOSL-1.0                         |      |      | FSF |     |     |
| L267 | JPL-image                        | SPDX |      |     |     |     |
| L268 | JPNIC                            | SPDX |      |     |     |     |
| L269 | JSON                             | SPDX | DFSG | FSF |     | GNU |
| L270 | Kastrup                          | SPDX |      |     |     |     |
| L271 | Kazlib                           | SPDX |      |     |     |     |

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|------|---------------------------------|------|------|-----|-----|-----|
| L272 | Knuth-CTAN                      | SPDX |      |     |     |     |
| L273 | LAL-1.2                         | SPDX |      |     |     |     |
| L274 | LAL-1.3                         | SPDX |      | FSF |     |     |
| L275 | LaTeX ecfonts                   |      |      | FSF |     |     |
| L276 | Latex2e                         | SPDX |      |     |     |     |
| L277 | Latex2e-translated-notice       | SPDX |      |     |     |     |
| L278 | Leptonica                       | SPDX |      |     |     |     |
| L279 | LGPL-2.0-only                   | SPDX |      | FSF | OSI |     |
| L280 | LGPL-2.0-or-later               | SPDX |      | FSF |     |     |
| L281 | LGPL-2.1-only                   | SPDX |      | FSF |     |     |
| L282 | LGPL-2.1-or-later               | SPDX |      | FSF |     |     |
| L283 | LGPL-3.0-only                   | SPDX | DFSG | FSF | OSI |     |
| L284 | LGPL-3.0-or-later               | SPDX |      | FSF |     |     |
| L285 | LGPLLR                          | SPDX |      | FSF |     |     |
| L286 | Lha                             |      |      | FSF |     | GNU |
| L287 | Libpng                          | SPDX |      |     |     |     |
| L288 | libpng-2.0                      | SPDX |      |     |     |     |
| L289 | libselinux-1.0                  | SPDX |      |     |     |     |
| L290 | libtiff                         | SPDX |      |     |     |     |
| L291 | libutil-David-Nugent            | SPDX |      |     |     |     |
| L292 | LiLiQ-P-1.1                     | SPDX |      |     | OSI |     |
| L293 | LiLiQ-R-1.1                     | SPDX |      |     | OSI |     |
| L294 | LiLiQ-Rplus-1.1                 | SPDX |      |     | OSI |     |
| L295 | Linux-man-pages-1-para          | SPDX |      |     |     |     |
| L296 | Linux-man-pages-copyleft        | SPDX |      |     |     |     |
| L297 | Linux-man-pages-copyleft-2-para | SPDX |      |     |     |     |
| L298 | Linux-man-pages-copyleft-var    | SPDX |      |     |     |     |
| L299 | Linux-OpenIB                    | SPDX |      |     |     |     |
| L300 | LLGPL                           |      |      | FSF |     |     |
| L301 | LOOP                            | SPDX |      |     |     |     |
| L302 | LPD-document                    | SPDX |      |     |     |     |
| L303 | LPL-1.0                         | SPDX |      |     |     |     |
| L304 | LPL-1.02                        | SPDX |      | FSF |     |     |
| L305 | LPPL-1.0                        | SPDX |      |     |     |     |
| L306 | LPPL-1.1                        | SPDX |      |     |     |     |

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|------|-----------------------------------|------|------|-----|-----|-----|
| L307 | LPPL-1.2                          | SPDX |      | FSF |     |     |
| L308 | LPPL-1.3a                         | SPDX |      | FSF |     |     |
| L309 | LPPL-1.3c                         | SPDX |      | FSF | OSI |     |
| L310 | lsof                              | SPDX |      |     |     |     |
| L311 | Lua license                       |      |      | FSF |     |     |
| L312 | Lucida-Bitmap-Fonts               | SPDX |      |     |     |     |
| L313 | LZMA-SDK-9.11-to-9.20             | SPDX |      |     |     |     |
| L314 | LZMA-SDK-9.22                     | SPDX |      |     |     |     |
| L315 | Mackerras-3-Clause                | SPDX |      |     |     |     |
| L316 | Mackerras-3-Clause-acknowledgment | SPDX |      |     |     |     |
| L317 | magaz                             | SPDX |      |     |     |     |
| L318 | mailprio                          | SPDX |      |     |     |     |
| L319 | MakeIndex                         | SPDX |      |     |     |     |
| L320 | Martin-Birgmeier                  | SPDX |      |     |     |     |
| L321 | McPhee-slideshow                  | SPDX |      |     |     |     |
| L322 | metamail                          | SPDX |      |     |     |     |
| L323 | Minpack                           | SPDX |      |     |     |     |
| L324 | MirOS                             | SPDX | DFSG | FSF | OSI |     |
| L325 | MIT                               | SPDX | DFSG |     | OSI |     |
| L326 | MIT-0                             | SPDX |      |     | OSI |     |
| L327 | MIT-advertising                   | SPDX |      |     |     |     |
| L328 | MIT-CMU                           | SPDX |      |     |     |     |
| L329 | MIT-enna                          | SPDX |      |     |     |     |
| L330 | MIT-feh                           | SPDX |      |     |     |     |
| L331 | MIT-Festival                      | SPDX |      |     |     |     |
| L332 | MIT-Modern-Variant                | SPDX |      |     |     |     |
| L333 | MIT-open-group                    | SPDX |      |     |     |     |
| L334 | MIT-testregex                     | SPDX |      |     |     |     |
| L335 | MIT-Wu                            | SPDX |      |     |     |     |
| L336 | MITNFA                            | SPDX |      |     |     |     |
| L337 | MMIXware                          | SPDX |      |     |     |     |
| L338 | Modified X11                      |      |      | FSF |     |     |
| L339 | ModifiedBSD                       |      |      |     |     | GNU |
| L340 | Motosoto                          | SPDX |      |     | OSI |     |
| L341 | MPEG-SSG                          | SPDX |      |     |     |     |

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|------|-------------------------------|------|------|-----|-----|-----|
| L342 | mpi-permissive                | SPDX |      |     |     |     |
| L343 | mpich2                        | SPDX |      |     |     |     |
| L344 | MPL                           |      |      | FSF |     | GNU |
| L345 | MPL-1.0                       | SPDX |      |     | OSI |     |
| L346 | MPL-1.1                       | SPDX |      | FSF | OSI |     |
| L347 | MPL-2.0                       | SPDX | DFSG | FSF | OSI |     |
| L348 | MPL-2.0-no-copyleft-exception | SPDX |      |     |     |     |
| L349 | mplus                         | SPDX |      |     |     |     |
| L350 | MS-LPL                        | SPDX |      |     |     |     |
| L351 | MS-PL                         | SPDX |      | FSF | OSI |     |
| L352 | MS-RL                         | SPDX |      | FSF | OSI |     |
| L353 | Ms-SS                         |      |      | FSF |     |     |
| L354 | MTLL                          | SPDX |      |     |     |     |
| L355 | MulanPSL-1.0                  | SPDX |      |     |     |     |
| L356 | MulanPSL-2.0                  | SPDX |      |     | OSI |     |
| L357 | Multics                       | SPDX |      |     | OSI |     |
| L358 | Mup                           | SPDX |      |     |     |     |
| L359 | NAIST-2003                    | SPDX |      |     |     |     |
| L360 | NASA-1.3                      | SPDX |      | FSF |     |     |
| L361 | Naumen                        | SPDX |      |     |     |     |
| L362 | NBPL-1.0                      | SPDX |      |     |     |     |
| L363 | NCGL-UK-2.0                   | SPDX |      |     |     |     |
| L364 | NCSA                          | SPDX |      | FSF | OSI | GNU |
| L365 | Net-SNMP                      | SPDX |      |     |     |     |
| L366 | NetCDF                        | SPDX |      |     |     |     |
| L367 | NetscapeJavaScript            |      |      |     |     | GNU |
| L368 | Newsletr                      | SPDX |      |     |     |     |
| L369 | NGPL                          | SPDX |      | FSF | OSI |     |
| L370 | NICTA-1.0                     | SPDX |      |     |     |     |
| L371 | NIST-PD                       | SPDX |      |     |     |     |
| L372 | NIST-PD-fallback              | SPDX |      |     |     |     |
| L373 | NIST-Software                 | SPDX |      |     |     |     |
| L374 | NLPL                          | SPDX |      |     |     |     |
| L375 | Nokia                         | SPDX |      | FSF | OSI | GNU |
| L376 | NoLicense                     |      |      |     |     | GNU |

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|------|----------------------------|------|------|-----|-----|-----|
| L377 | NOSL                       | SPDX |      | FSF |     | GNU |
| L378 | Noweb                      | SPDX |      |     |     |     |
| L379 | NPL-1.0                    | SPDX |      |     |     |     |
| L380 | NPL-1.1                    | SPDX |      | FSF |     |     |
| L381 | NPOSL-3.0                  | SPDX |      |     | OSI |     |
| L382 | NRL                        | SPDX |      |     |     |     |
| L383 | NTP                        | SPDX |      |     | OSI |     |
| L384 | NTP-0                      | SPDX |      |     |     |     |
| L385 | O-UDA-1.0                  | SPDX |      |     |     |     |
| L386 | OCCT-PL                    | SPDX |      |     |     |     |
| L387 | OCL-1.0                    |      |      | FSF |     |     |
| L388 | OCLC-2.0                   | SPDX |      |     |     |     |
| L389 | Oculus VR Rift SDK License |      |      | FSF |     |     |
| L390 | ODbL-1.0                   | SPDX |      | FSF |     |     |
| L391 | OFFIS                      | SPDX |      |     |     |     |
| L392 | OFL-1.0                    | SPDX |      |     |     |     |
| L393 | OFL-1.0-no-RFN             | SPDX |      |     |     |     |
| L394 | OFL-1.0-RFN                | SPDX |      |     |     |     |
| L395 | OFL-1.1                    | SPDX | DFSG | FSF | OSI |     |
| L396 | OFL-1.1-no-RFN             | SPDX |      |     |     |     |
| L397 | OFL-1.1-RFN                | SPDX |      |     |     |     |
| L398 | OGC-1.0                    | SPDX |      |     |     |     |
| L399 | OGL-Canada-2.0             | SPDX |      |     |     |     |
| L400 | OGTSL                      | SPDX |      |     | OSI |     |
| L401 | OLDAP-1.1                  | SPDX |      |     |     |     |
| L402 | OLDAP-1.2                  | SPDX |      |     |     |     |
| L403 | OLDAP-1.3                  | SPDX |      |     |     |     |
| L404 | OLDAP-1.4                  | SPDX |      |     |     |     |
| L405 | OLDAP-2.0                  | SPDX |      |     |     |     |
| L406 | OLDAP-2.0.1                | SPDX |      |     |     |     |
| L407 | OLDAP-2.1                  | SPDX |      |     |     |     |
| L408 | OLDAP-2.2                  | SPDX |      |     |     |     |
| L409 | OLDAP-2.2.1                | SPDX |      |     |     |     |
| L410 | OLDAP-2.2.2                | SPDX |      |     |     |     |
| L411 | OLDAP-2.3                  | SPDX |      | FSF |     |     |

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| L412 | OLDAP-2.4                     | SPDX |      |     |     |     |
| L413 | OLDAP-2.5                     | SPDX |      |     |     |     |
| L414 | OLDAP-2.6                     | SPDX |      |     |     |     |
| L415 | OLDAP-2.7                     | SPDX |      | FSF |     |     |
| L416 | OLDAP-2.8                     | SPDX |      | FSF | OSI |     |
| L417 | oldOpenLDAP                   |      |      |     |     | GNU |
| L418 | OLFL-1.3                      | SPDX |      |     | OSI |     |
| L419 | OML                           | SPDX |      |     |     |     |
| L420 | Open Publication License v1.0 |      |      | FSF |     |     |
| L421 | OpenPBS-2.3                   | SPDX | DFSG |     |     |     |
| L422 | OpenSSL                       | SPDX |      | FSF |     | GNU |
| L423 | OpenSSL-standalone            | SPDX |      |     |     |     |
| L424 | OpenVision                    | SPDX |      |     |     |     |
| L425 | OPL-1.0                       | SPDX | DFSG | FSF |     |     |
| L426 | OPL-UK-3.0                    | SPDX |      |     |     |     |
| L427 | OPUBL-1.0                     | SPDX |      |     |     |     |
| L428 | OriginalBSD                   |      |      |     |     | GNU |
| L429 | OSET-PL-2.1                   | SPDX |      |     | OSI |     |
| L430 | OSL                           |      |      |     |     | GNU |
| L431 | OSL-1.0                       | SPDX |      |     | OSI |     |
| L432 | OSL-1.1                       | SPDX | DFSG |     |     |     |
| L433 | OSL-2.0                       | SPDX |      |     |     |     |
| L434 | OSL-2.1                       | SPDX |      |     | OSI |     |
| L435 | OSL-3.0                       | SPDX |      | FSF | OSI |     |
| L436 | PADL                          | SPDX |      |     |     |     |
| L437 | Parity-6.0.0                  | SPDX |      |     |     |     |
| L438 | Parity-7.0.0                  | SPDX |      |     |     |     |
| L439 | PerlLicense                   |      |      |     |     | GNU |
| L440 | Phorum-2.0                    |      |      | FSF |     |     |
| L441 | PHP-3.0                       | SPDX |      | FSF | OSI |     |
| L442 | PHP-3.01                      | SPDX |      | FSF | OSI |     |
| L443 | PINE                          |      |      | FSF |     | GNU |
| L444 | Pixar                         | SPDX |      |     |     |     |
| L445 | Plexus                        | SPDX |      |     |     |     |
| L446 | pnmstitch                     | SPDX |      |     |     |     |

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|------|-------------------------------|------|------|-----|-----|-----|
| L447 | PolyForm-Noncommercial-1.0.0  | SPDX |      |     |     |     |
| L448 | PolyForm-Small-Business-1.0.0 | SPDX |      |     |     |     |
| L449 | PostgreSQL                    | SPDX |      |     | OSI |     |
| L450 | PPL3a                         |      |      |     |     | GNU |
| L451 | PSF-2.0                       | SPDX |      |     | OSI |     |
| L452 | psfrag                        | SPDX |      |     |     |     |
| L453 | psutils                       | SPDX |      |     |     |     |
| L454 | PublicDomain                  |      |      | FSF |     | GNU |
| L455 | Python-1.6a2                  |      |      | FSF |     |     |
| L456 | Python-2.0                    | SPDX |      |     |     |     |
| L457 | Python-2.0.1                  | SPDX |      | FSF |     |     |
| L458 | python-ldap                   | SPDX |      |     |     |     |
| L459 | Qhull                         | SPDX |      |     |     |     |
| L460 | QPL-1.0                       | SPDX | DFSG | FSF | OSI |     |
| L461 | QPL-1.0-INRIA-2004            | SPDX |      |     |     |     |
| L462 | radvd                         | SPDX |      |     |     |     |
| L463 | Rdisc                         | SPDX |      |     |     |     |
| L464 | RHeCos-1.1                    | SPDX |      | FSF |     |     |
| L465 | RPL-1.1                       | SPDX |      |     | OSI |     |
| L466 | RPL-1.3                       |      |      | FSF |     |     |
| L467 | RPL-1.5                       | SPDX |      |     | OSI |     |
| L468 | RPSL-1.0                      | SPDX | DFSG | FSF | OSI |     |
| L469 | RSA-MD                        | SPDX |      |     |     |     |
| L470 | RSCPL                         | SPDX |      |     | OSI |     |
| L471 | Ruby                          | SPDX |      | FSF |     | GNU |
| L472 | SAX-PD                        | SPDX |      |     |     |     |
| L473 | SAX-PD-2.0                    | SPDX |      |     |     |     |
| L474 | Saxpath                       | SPDX |      |     |     |     |
| L475 | SCEA                          | SPDX |      |     |     |     |
| L476 | SchemeReport                  | SPDX |      |     |     |     |
| L477 | Scilab-old                    |      |      | FSF |     |     |
| L478 | Scratch                       |      |      | FSF |     | GNU |
| L479 | SCSL-2.8                      |      |      | FSF |     |     |
| L480 | Sendmail                      | SPDX |      | FSF |     |     |
| L481 | Sendmail-8.23                 | SPDX |      |     |     |     |



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| L482 | SGI-B-1.0                     | SPDX |      |     |     |     |
| L483 | SGI-B-1.1                     | SPDX |      |     |     |     |
| L484 | SGI-B-2.0                     | SPDX |      | FSF |     |     |
| L485 | SGI-OpenGL                    | SPDX |      |     |     |     |
| L486 | SGIFreeB                      |      |      |     |     | GNU |
| L487 | SGP4                          | SPDX |      |     |     |     |
| L488 | SHL-0.5                       | SPDX |      |     |     |     |
| L489 | SHL-0.51                      | SPDX |      |     |     |     |
| L490 | SimPL-2.0                     | SPDX |      |     | OSI |     |
| L491 | SimpleM                       |      |      | FSF |     |     |
| L492 | SimplePermissive              |      |      | FSF |     |     |
| L493 | SimplePermissiveNoNonWarranty |      |      | FSF |     |     |
| L494 | SISSL                         | SPDX |      | FSF | OSI | GNU |
| L495 | SISSL-1.2                     | SPDX |      | FSF |     |     |
| L496 | SL                            | SPDX |      |     |     |     |
| L497 | Sleepycat                     | SPDX |      | FSF | OSI |     |
| L498 | SMLNJ                         | SPDX |      | FSF |     |     |
| L499 | SMPPL                         | SPDX |      |     |     |     |
| L500 | SNIA                          | SPDX |      |     |     |     |
| L501 | snprintf                      | SPDX |      |     |     |     |
| L502 | softSurfer                    | SPDX |      |     |     |     |
| L503 | Soundex                       | SPDX |      |     |     |     |
| L504 | Spencer-86                    | SPDX |      | FSF |     |     |
| L505 | Spencer-94                    | SPDX |      |     |     |     |
| L506 | Spencer-99                    | SPDX |      |     |     |     |
| L507 | spin                          |      | DFSG |     |     |     |
| L508 | SPL-1.0                       | SPDX |      | FSF | OSI |     |
| L509 | Squeak-old                    |      |      | FSF |     |     |
| L510 | ssh-keyscan                   | SPDX |      |     |     |     |
| L511 | SSH-OpenSSH                   | SPDX |      |     |     |     |
| L512 | SSH-short                     | SPDX |      |     |     |     |
| L513 | SSLeay-standalone             | SPDX |      |     |     |     |
| L514 | SSPL-1.0                      | SPDX |      |     |     |     |
| L515 | SSSCFR-1.1                    |      |      | FSF |     |     |
| L516 | StandardMLofNJ                |      |      |     |     | GNU |

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| L517 | SugarCRM-1.1.3   | SPDX |     |     |     |
| L518 | Sun-PPP          | SPDX |     |     |     |
| L519 | SunPro           | SPDX |     |     |     |
| L520 | SWL              | SPDX |     |     |     |
| L521 | swrule           | SPDX |     |     |     |
| L522 | Symlinks         | SPDX |     |     |     |
| L523 | TAPR-OHL-1.0     | SPDX |     |     |     |
| L524 | TCL              | SPDX | FSF |     |     |
| L525 | TCP-wrappers     | SPDX |     |     |     |
| L526 | TermReadKey      | SPDX |     |     |     |
| L527 | TGPPL-1.0        | SPDX | FSF |     |     |
| L528 | THL-1.1          |      | FSF |     |     |
| L529 | TMate            | SPDX |     |     |     |
| L530 | TORQUE-1.1       | SPDX |     |     |     |
| L531 | TOSL             | SPDX |     |     |     |
| L532 | TPDL             | SPDX |     |     |     |
| L533 | TPL-1.0          | SPDX |     |     |     |
| L534 | TrueCrypt        |      | FSF |     |     |
| L535 | TTWL             | SPDX |     |     |     |
| L536 | TTYP0            | SPDX |     |     |     |
| L537 | TU-Berlin-1.0    | SPDX |     |     |     |
| L538 | TU-Berlin-2.0    | SPDX |     |     |     |
| L539 | UCAR             | SPDX |     |     |     |
| L540 | UCL-1.0          | SPDX |     | OSI |     |
| L541 | ulem             | SPDX |     |     |     |
| L542 | UMich-Merit      | SPDX |     |     |     |
| L543 | Unicode-3.0      | SPDX |     |     |     |
| L544 | Unicode-DFS-2012 |      | FSF |     |     |
| L545 | Unicode-DFS-2015 | SPDX |     | OSI |     |
| L546 | Unicode-DFS-2016 | SPDX |     |     |     |
| L547 | Unicode-TOU      | SPDX |     |     |     |
| L548 | UnixCrypt        | SPDX |     |     |     |
| L549 | Unlicense        | SPDX |     | OSI | GNU |
| L550 | UPL-1.0          | SPDX |     | OSI |     |
| L551 | URT-RLE          | SPDX |     |     |     |

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|------|--------------------------------------|------|------|-----|-----|
| L552 | UtahPublicLicense                    |      |      |     | GNU |
| L553 | Vim                                  | SPDX |      |     | GNU |
| L554 | VOSTROM                              | SPDX |      |     |     |
| L555 | VSL-0.1                              |      |      | OSI |     |
| L556 | VSL-1.0                              | SPDX |      |     |     |
| L557 | W3C                                  | SPDX |      |     | GNU |
| L558 | W3C-19980720                         | SPDX |      |     |     |
| L559 | W3C-20150513                         | SPDX |      | OSI |     |
| L560 | w3m                                  | SPDX |      |     |     |
| L561 | Watcom-1.0                           | SPDX |      |     |     |
| L562 | WebM                                 |      |      |     | GNU |
| L563 | Widget-Workshop                      | SPDX |      |     |     |
| L564 | Wsuipa                               | SPDX |      |     |     |
| L565 | WTFPL                                | SPDX | DFSG |     | GNU |
| L566 | wxWindows                            |      |      | OSI |     |
| L567 | x-oz                                 |      | DFSG |     |     |
| L568 | X11                                  | SPDX |      |     |     |
| L569 | X11-distribute-modifications-variant | SPDX |      |     |     |
| L570 | X11License                           |      |      |     | GNU |
| L571 | Xdebug-1.03                          | SPDX |      |     |     |
| L572 | Xerox                                | SPDX |      |     |     |
| L573 | Xfig                                 | SPDX |      |     |     |
| L574 | XFree86-1.1                          | SPDX |      |     |     |
| L575 | xinetd                               | SPDX |      |     | GNU |
| L576 | xkeyboard-config-Zinoviev            | SPDX |      |     |     |
| L577 | xlock                                | SPDX |      |     |     |
| L578 | Xnet                                 | SPDX |      | OSI |     |
| L579 | xpp                                  | SPDX |      |     |     |
| L580 | XSkat                                | SPDX |      |     |     |
| L581 | Yahoo                                |      |      |     | GNU |
| L582 | YPL-1.0                              | SPDX |      |     |     |
| L583 | YPL-1.1                              | SPDX |      |     |     |
| L584 | Zed                                  | SPDX |      |     |     |
| L585 | Zeeff                                | SPDX |      |     |     |
| L586 | Zend-2.0                             | SPDX |      |     |     |

|      |                      |      |      |  |     |     |
|------|----------------------|------|------|--|-----|-----|
| L587 | Zimbra-1.3           | SPDX |      |  |     |     |
| L588 | Zimbra-1.4           | SPDX |      |  |     |     |
| L589 | Zlib                 | SPDX | DFSG |  | OSI | GNU |
| L590 | zlib-acknowledgement | SPDX |      |  |     |     |
| L591 | Zope                 |      |      |  |     | GNU |
| L592 | ZPL-1.1              | SPDX |      |  |     |     |
| L593 | ZPL-2.0              | SPDX |      |  |     |     |
| L594 | ZPL-2.1              | SPDX |      |  |     |     |