Python Package Metadata Management

Basic Databases

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Contents

1 Introduction

1.1 Brief Description

In traditional Unix-like operating systems like GNU/Linux distributions and BSD-based OSes, package managers tries to synchronize the packages metadata (such as available versions and dependencies) with that of central repositories. While this proves to be reliable and efficient, language-specific package managers do not usually have such synchronized databases, since they focus on development libraries which have more flexible contraints.

Within the Python packaging ecosystem, this is the case, where package managers like `pip` needs to fetch metadata of each package to be installed to find out dependencies and other information. This turns out to have heavy performance penalty on the dependency resolution process alone, which is already a NP-hard problem. This project explores ways to store these metadata in an efficient in a database, to be used in practice either locally or in a local/regional network, to avoid Python package managers from having to fetch (and potentially build) entire packages just to find out if it conflicts with others.

1.2 Authors and Credits

The work has been undertaken by group number 8, whose members are listed in the following table.

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*`https://github.com/McSinyx/cheese-shop`

2 User Requirements

This project aims to provide a database for metadata queries and Python packages exploration. We try to replicate the PyPI's XML-RPC API [1], which supports queris similar to the following:

- `list_projects()`: Retrieve a list of registered project names.
- `project_releases(project)`: Retrieve a list of releases for the given `project`, ordered by version.
- `project_release_latest()`: Retrieve the latest release of the given `project`.
- `belong_to(name)`: Retrieve a list of projects whose author is `name`.
- `browse(classifier)`: Retrieve a list of (`project`, `version`) of all releases classified with all of the given classifier.
- `release_data(project, version)`: Retrieve the following metadata matching the given release: project, version, homepage, author, author's email, summary, license, keywords, classifiers and dependencies
- `search_name(pattern)`: Retrieve a list of (`project`, `version`, `summary`) where the project name matches the pattern.
- `search_summary(pattern)`: Retrieve a list of (`project`, `version`, `summary`) where the summary matches the pattern.

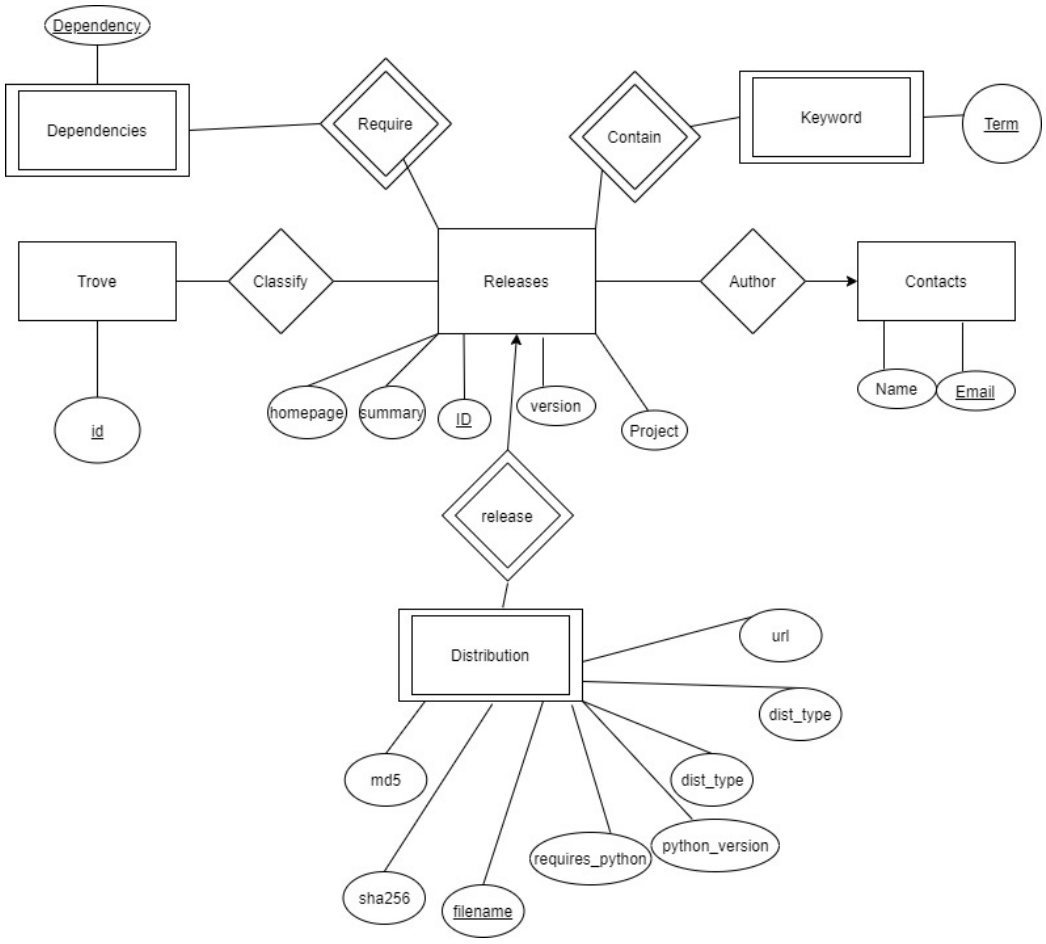
3 Data Definition

3.1 Entity Relationship Diagram

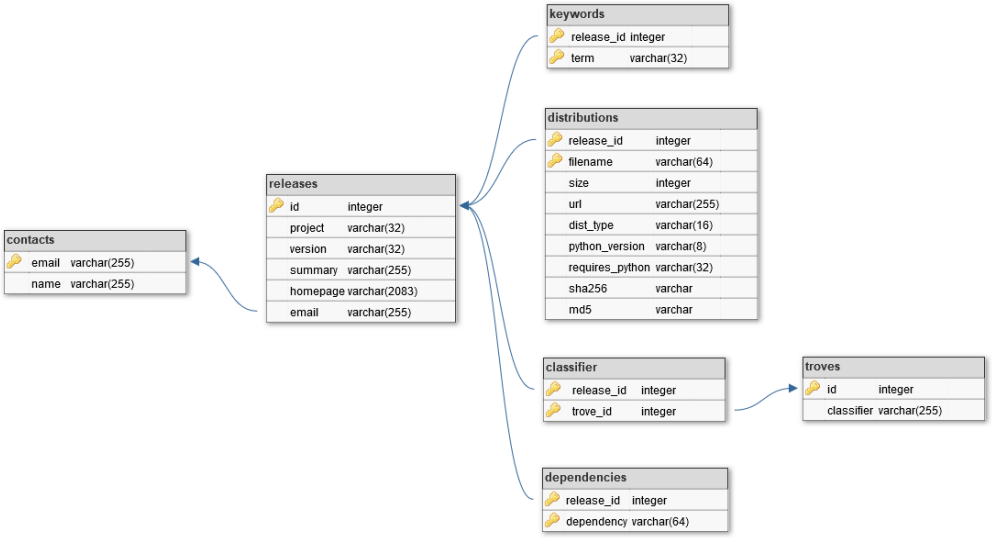
The entity relationship diagram represents the relationship between each of its entity set of data extracted from projects:

- Author(Releases-Contact: Many-One): Within each release, there could be one author, due to data extraction method doesn't support multi-author. Yet an author could have multiple releases under per name.
- Require(Releases-Dependencies: Many-Many): Every release would require a number of dependencies, and many dependencies can each be used by multiple releases.

- Classify(Releases-Trove: Many-Many): This relationship indicates the relationship between trove classifier and each releases, with many release could be classified under one trove classifier, and a release could be classified by many classifiers.
- Contain(Releases-Keyword: Many-Many): A release has many keywords, and also a keyword can also be in many different releases.
- Release(Releases-Distribution: One-Many): Within each releases, a number of distribution(s) would be released. A distribution could relate to only one releases, but many distributions could be released in the same releases.



3.2 Database Schema



3.2.1 releases

This entity set represents each releases of the project,include the name of the project and its version in addition to summary,homepage and author's email. The ID of each releases is the primary key to represent each one of them. This release ID is also the foreign key of many primary key in other entity set.

3.2.2 keywords

Containing both the ID of the releases and the terminology as primary key,this entity represent the keywords of a specific release.

3.2.3 contact

Containing contact information of the author,including email (primary key) and name

3.2.4 information

Specific information of each releases. Containing release ID,summary,homepage and author's email of the releases.

3.2.5 trove

This entity set represent Trove classifiers,identified by its ID.

3.2.6 classifiers

Containing the release ID and Trove classifiers ID,this table has the role of representing the relationship of trove and releases

3.2.7 Distribution

This entity set represents the distribution of each releases. With its primary key its release ID along with its filename,each distribution contains the url,python version and the python version it requires,the distribtions it requires and its digests (a dictionary) sha256 and md5

4 Data Query

4.1 Project Listing

Retrieve a list of the project names registered with the project index.

4.2 Project Releases

Retrieve a list of the releases registered for the given project name, ordered by version.

4.3 Users

Retrieve a list of role, user for a given project name.

4.4 Release URLs

Retrieve a list of download URLs for the given release version.

4.5 Release Data

retrieve metadata describing a specific release version.

4.6 Classifiers

Retrieve a list of name, version of all releases classified with all of the given classifiers, classifiers must be a list of Trove classifier strings.

5 Conclusion

6 References

[1] The Python Packaging Authority. *PyPI's XML-RPC methods*. Warehouse documentation.