Install instructions with a very basic usage example

A very basic usage example for reproduction means: reproducing our study on one version of projects (i.e. LineageOS-18.1) but covering the complete study process (i.e., from intermediate data to final results). We provide detailed instructions to prepare an executable environment, install the tool and how to test it with example.

1. Prepare executable environment

1) JDK environment:

Please download 11(+) JDK package at the official site :

https://www.oracle.com/in/java/technologies/javase/jdk11-archive-downloads.html

Then follow the official installation guide to set PATH:

https://docs.oracle.com/en/java/javase/19/install/overview-jdk-installation.html#GUID-8677A77F-231A-40F7-98B9-1FD0B48C346A

2) Python environment:

Please download 3.7(+) python at the official site:

https://www.python.org/downloads/

3) Upgrade pip to latest version

Run command at console: pip3 install --upgrade pip

4) Install Git

Please follow the official guide to install Git:

https://git-scm.com/book/en/v2/Getting-Started-Installing-Git

5) Install Gitpython:

Run command at console: pip3 install Gitpython

2. Install DepFCD

DepFCD is an executable file which is located under the 'Method' folder after unpacking our artifact. The detailed instructions to use it are provided below.

3. Prepare test data

1) Clone corresponding customized Android Frameworks into directory platforms.

To clone Android /framework/base, do:

git clone https://android.googlesource.com/platform/frameworks/base

To clone LineageOS /framework/base, do:

git clone https://github.com/LineageOS/android_frameworks_base.git

2) Reset the version of the downstream and the corresponding upstream Android projects.

For Example, for LineagsOS-18.1, the merge point is:

Merge point	LineageOS branch	LineageOS parent commit	Android branch	Android parent commit
7f7fc2562a95be630dbe609e8fb70383dcfada4f	lineage-18.1	cf0606c2f73	android11-gsi	49d8b986ddd

To reset the code status for Android, do:

git checkout android11-gsi

git reset --hard 49d8b986ddd

To reset the code status for LineageOS, do:

git checkout lineage-18.1

git reset --hard cf0606c2f73

4. Entity and Dependency Extraction

To execute `enre_java.jar`, we need to specify source code path, hidden flag file path, do

java -jar enre_java.jar java <local_path_to_repo\LineageOS\base> lineage -hd hiddenapi-flags.csv -o <output_file_name>

5. Entity Ownership and Intrusive Operation Identification (DepFCD)

We integrate the tool `RefactoringMiner` including

- `ref_tool\lib\RefactoringMiner-2.2.0.jar` - the refactoring infomation detection tool, there are some `jar` required for the tool in the `ref_tool\lib` directory
- `ref_tool\bin\RefactoringMiner` - a script that executes the tool `Refactoring Miner-2.2.0.jar` to generate refactoring information

To reproduce, we need to specify source code path, source dependencies graph json file path, do

dep_facade.exe -cc <local_path_to_downstream_repo\LineageOS\base> -ca <local_path_to_upstream_repo\android\base> -c <path_to_downstream_dependency_graph, i.e. D:\LineageOS\lineage.json> -a <path_to_upstream_dependency_graph, i.e. D:\android\android.json> -ref ref_tool\bin\RefactoringMiner -o <output_path>

During the detecting process， we need to acquire all commits history and retrieve the whole refactoring operation of the analyzed project, which is time-consuming. To be convenient, you can use the `all_base_commits.csv` and `ref.json` for LineageOS-18.1 which is the result of RefactoringMiner in the folder `data\Methodology\The detection of Dependency facade \Entity Ownership Identification`. The only thing we need to do is moving them to the `output_path` which is specified in the above command.

The WARNING related to `log4j` during execution can be ignorable.